THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Both in tone and demand the iron market has improved in the past week. No doubt the better financial outlook is responsible for this, hesitation in many cases being followed by action, when it appeared that even Wall Street pessimism was rapidly being cured. The developments in connection with the meetings of plate and structural steel manufacturers in New York last week confirmed all that has been said recently about the heavy demands upon these two lines of production —requirements that guarantee full operation to the middle of 1903, with capacity taken in part for some time beyond that. Bookings in plates amount to 700,000 tons and in shapes to 600,000 tons. The plate mill agreement was not renewed without some friction over tonnage allotments but the changes finally made in percentages were slight. In the past week structural mills have booked some further good business, Chicago reporting one 8,000-ton contract and several of 1,000 tons, while at Cleveland 5,000 tons was placed by Northern Ohio bridge works. Sheets are the only line of finished material in which the situation is not a strong one, with indications promising for the new year. The requirements of steel car works are to be greater than ever in 1903 and there are no indications yet that new enterprises or intended enlargements of plant have been laid aside because of high prices or because of untoward signs. The recent advances to labor are an important factor in continuing present prosperity. Latest among these is an advance just announced by the H. C. Frick Coke Co. amounting to about 8 percent. The demand of the bituminous coal miners of the Central West for an advance effective April 1 means a further increase in manufacturing costs, following that which the railroads will impose with the new year. The pig iron market shows increasing inquiry, almost entirely for delivery in the first half of 1903. It would appear that more consumers have yet to buy for a portion of their requirements in the first half than sellers have counted on. Meantime offerings of spot iron have rather increased, and prices for such deliveries are close to those for future contracts. Buyers who have not had deliveries at the contract rate are disposed to believe that considerable contract iron has been going to meet needs of urgent buyers willing to pay the price. Southern furnaces have had a quiet week, inquiry being limited to the first half of next year. In forge iron some interest has been awakened by the low price made on a recent 5,000 ton sale for delivery next year, there being exceptional features in this transaction, which was reported at $14 Birmingham. Pipe foundries are reported in the market this week for considerable quantities of forge. Taking effect with Jan. 1 freights on Southern iron to points north of the Ohio River are advanced 20 cents a ton. The Bessemer pig iron market is quiet. Merchant furnaces are very far behind on deliveries, and February will have passed before all the 1902 iron will go off the books. Rumors of further absorptions by the steel corporation are in the air, following the taking over of the Union Steel Co. and the buying of the Troy steel plant, no part of which will be operated save the blast furnaces. These recent moves make the corporation more independent of the pig iron market, while the coke troubles of outside producers make any considerable increase of pig iron production from that source quite problematic. The trade is on the alert for fresh signs of a policy on the part of the corporation looking to more complete control of ore, pig iron and steel production.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Dec. 24.

At meetings of the steel plate and structural steel manufacturers, held at New York last week, existing agreements were renewed and ruling quotations were reaffirmed. From reports presented by the manufacturers at this meeting it was shown that orders on their books for next year cover the tonnage of the plate mills through the month of June and in one case a regular contract involves a large tonnage for each month in the year. The capacity of the structural mills is taken up through the month of July. Orders for plates for 1903 delivery aggregate 700,000 tons, while the aggregate tonnage placed with the structural mills amounts to 600,000 tons. Of the plate capacity the steel car manufacturers of the country will consume fully 500,000 tons and a large portion of the structural output will also find its way into steel cars. One of the large local mills has practically its entire plate output taken up through the month of November, although sufficient capacity has been reserved to take care of small orders throughout the year for prompt shipment. A meeting of the bolt manufacturers was also held in New York last week but no changes in prices were made.

Locally the pig iron producing capacity is to be still further increased by the erection of one and possibly two stacks by the Jones & Laughlin Steel Co. The matter is now under consideration and plans are being prepared. The steel producing capacity of this company's plants exceeds its pig iron capacity fully 1,000 tons daily and two furnaces with a daily capacity of 500 tons each will furnish all the iron required for the increased steel capacity that has been placed in operation during the past six months. Within a few weeks the Carnegie Steel Co. will blow in two additional stacks located respectively at its Carrie and Edgar Thomson plants. Early in February the Clairton Steel Co. will also blow in one of its three stacks. Owing to the existing shortage of steel making iron this increased capacity will relieve the situation to a great extent.

From figures obtainable this week the merchant furnaces in the Mahoning and Shenango Valleys will complete shipments on basic and Bessemer iron, specified for delivery this year during the last week in February, providing the furnaces are able to operate at their normal capacity. This is not probable, however, owing to the bad coke shipments that are expected during the months of January and February, and deliveries on iron for 1902 will probably run into March. This will throw deliveries for the first quarter into the second quarter of the year and much of the iron contracted for delivery in the second quarter cannot possibly be shipped before the first two months of the second half, this, of course, providing the furnaces secure sufficient coke to permit them to operate properly.

During the months of January and February the sheet and pipe producing capacity will be still further increased by the output of the 14 mills of the Sharon Sheet Co., at Sharon, Pa., and the pipe plant at this place. The tin plate capacity will also be increased by the operation of the tin mill of the McKeesport Tin Plate Co., at McKeesport, Pa., which consists of ten mills. While the future selling policy of the United

States Steel Corporation of the products of the Sharon Steel Co. and the Union Steel Co. has not yet been fully outlined, it is probable that the American Sheet Steel Co. will market the sheet output; the National Tube Co. will take care of the pipe output and the American Steel & Wire Co. will market the wire and wire nail output of both plants. The tin plate output of the twenty mills of the Sharon Steel Co. has been marketed by the American Tin Plate Co. since the mills have been in operation and this plan will be continued. With the added wire and wire nail capacity there is every indication that some of the smaller and less modern mills of the American Steel & Wire Co. will be dismantled in the near future.

PIG IRON.—The market continues quiet and there is little buying for either prompt or future shipments. There has been further buying of prompt Middlesboro iron by founders in this district at prices ranging from $21.25 to $21.50, Pittsburg, and this buying will no doubt continue for some time owing to the high ruling quotations on prompt Northern No. 2. Bessemer iron for delivery during the second quarter is quoted at $21.50 to $21.75 at the furnace, while some operators are asking $22 for their product. Prompt Bessemer is $23.50 to $24, Pittsburg. There is little forge moving. We make the following quotations:

Bessemer, Valley	$21 50 to 22 00
Bessemer, Pittsburg	22 25 to 22 75
No. 1 Foundry	24 00 to 24 50
No. 2 Foundry	23 00 to 23 50
Gray Forge, Pittsburg	20 75 to 21 00
Chilled Basic, Valley	21 00 to 21 50
Chilled Basic, Pittsburg	21 75 to 22 25

STEEL.—Open-hearth billets for prompt delivery have advanced sharply during the past week and we note sales of small lots at $32 to $33 at mill, Pittsburg. For forward delivery $30 to $31 can be done on a desirable tonnage. Bessemer billets are held at $29.50 to $30. Wire rods are quiet and are held at $35 to $36.

FERRO-MANGANESE.—There is some buying of small lots of English ferro for early delivery at $55 per ton delivered at buyer's mill. In more than 50 ton lots, however, $50 can be done. There is practically no demand for the German product inasmuch as it is held at prices ranging from $1.50 to $2 per ton above that of the English producers.

MUCK BAR.—The market continues quiet and there has been no change in prices. Neutral muck is quoted at $33 to $33.50 for early delivery.

SKELP.—We note the sale of 1,500 tons of steel skelp for delivery within the next two months at 1.92½c, Pittsburg. Iron skelp is held at 1.95c to 2c.

RAILS AND TRACK MATERIAL.—The rail tonnage for next year has been further increased during the week by the placing of several small orders calling for about 15,000 tons. The light rail market continues active at unchanged prices. We make the following quotations: Standard sections, 50 pounds and over, in lots of 200 tons and over, $28; car lots and less than 200 tons, $30; less than car lots, $32; light rails, 8 pounds, $43; 12 pounds, $42; 16 pounds, $40; 20 pounds, $39; 25 to 40 pounds, $37 to $38. Track materials: Spikes, 2.15c to 2.25c; track bolts, square heads, 2.05c; hexagon heads, 2.65c; fish plates, 1.60c.

PLATES.—At the meeting of the plate manufacturers held in New York last week prices were reaffirmed and there is every indication that the present pool quotations will be continued throughout 1903: Tank plates, ¼-inch thick and up to 100 inches in width, 1.60c at mill, Pittsburg; flange and boiler steel, 1.75c; marine, ordinary, fire-box, A. B. M. A. specifications, 1.80c; still bottom steel, 1.80c; locomotive fire-box, not less than 2.10c, and it ranges in price to 3c. Plate more than 100 inches wide, 5c extra 100 pounds. Plate 3-16 of an inch in thickness, $2 extra; gauges Nos. 7 and 8, $3 extra. These quotations are based on carload lots, with 5c extra a hundred pounds for less than carload lots. Terms, net cash, in 30 days.

BARS.—The local iron bar market has been quite active during the past ten days, orders for refined bars amounting to nearly 2,000 tons having been placed at 1.80c. Considerable business was also done in common bars at 1.70c. The latter figure is now being quoted on all bar iron business, whether for delivery in this district or elsewhere. We make the following quotations: Bessemer steel bars, 1.60c; open-hearth, 1.70c; plow beams and cultivator beams, 1.60c, net; channels, angles, zees and tees, Bessemer under 3 inches, 1.70c; over 3 inches, 1.80c; bar iron, 1.70c to 1.80c, Pittsburg, with freight added to point of delivery. Hoops and bands are quoted at 1.90c, full extras, in 250-ton lots and over, and 2c in less than 250-ton lots.

STRUCTURAL MATERIAL.—At the meeting of the structural material manufacturers held in New York last week the agreement was renewed for another year and existing quotations were reaffirmed: Beams and channels, 3 to 15 inches, 1.60c; 18 to 24 inches, 1.70c; tees, 1.65c; zees, 1.60c; angles from 3 to 16 inches, 1.60c; universal mill plates, 1.60c.

PIPES AND TUBES.—The amount of new business that is being placed for merchant pipe continues very heavy for this season of the year. Some of the independent manufacturers are meeting the discounts of the National Tube Co. and in a few instances they have made slight concessions to secure the business. Quotations in carload lots, plus the freight to destination are as follows:

MERCHANT PIPE.

	Steel		Guaranteed Wrought Iron	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛, ¼ and ⅜ inch	68	58	65	55
½ inch	70	60	67	57
¾ to 6 inch	75	65	72	62
7 to 12 inch	73	63	70	60
Plugged and Reamed				
1 to 4 inch	73	63	70	60
Cut 3 to 6 feet				
⅛, ¼ and ⅜ inch	63	52	60	49
½ inch	65	54	62	51
¾ to 6 inch	71	60	68	57
7 to 12 inch	69	57	65	54
Cut 6 feet and longer				
⅛, ¼ and ⅜ inch	64	53	61	50
½ inch	66	55	63	52
¾ to 6 inch	73	61	69	58
7 to 12 inch	70	58	66	55
Extra Strong Plain End				
⅛ to 8 inch	69	59	65	55
Threads only—Same as Plain End, plus 1½ percent net. Threads and Couplings—Same as Plain End, plus 2½ percent net.				
Double Extra Strong Plain End				
¼ to 8 inch	61	51	57	47
Threads only—Same as Plain End, plus 2 percent net. Threads and Couplings—Same as Plain End, plus 3 percent net.				

NOTE: Orders for less than carload will be charged at 12½ percent advance. Extra and Double Extra Strong Cut Lengths, lower random discounts by 10 percent net for 6 feet and longer, and 15 percent net for 3 to 6 feet.

BOILER TUBES.

Steel.

	Percent.
1 to 1½ inches	45
2¼ to 5 inches	62½
1¾ to 2¼ and 6 to 13 inches	52½

Iron.

	Percent.
1 to 1½ inches	36½
2¼ to 5 inches	45½
1¾ to 2¼ and 6 to 13 inches	35½

CASING.

	S. and S. Percent.
2 to 3 inches	58
3¼ to 4 inches	60
4¼ to 12½ inches	63

SHEETS.—The sheet trade continues quiet, although inquiries received during the past few days indicate that there will be considerable buying early next year. Black sheets in 500 bundle lots and over are held as follows: No. 28, 2.75c; No. 27, 2.65c; No. 26, 2.55c; Nos. 22 and 24, 2.45c; Nos. 18 and 20, 2.35c; Nos. 14 and 16, 2.25c; Nos. 10 and 12, 2.10c to 2.15c. Galvanized: No. 16, 2.60c; No. 18, 2.85c; No. 26, 3.35c; No. 27, 3.60c; No. 28, 3.85c; No. 29, 4.35c; No. 30, 4.50c.

MERCHANT STEEL.—A meeting of the shafting manufacturers will be held in January but it is not probable that any changes in existing discounts will be made. Our quotations are as follows: Turned cold rolled and ground shafting, 47 off in carload lots and 42 percent off in less than carload lots; tire steel, 2.15c to 2.25c; spring steel, 2.25c to 2.35c; toe calk, 2.30c to 2.40c. The following differentials maintain: Less than 2,000 pounds of a size and not less than 1,000 pounds, 10 cents advance; less than 1,000 pounds of a size, 30 cents advance. Tool steel is quoted 7 cents and upwards, according to the grade.

WIRE AND WIRE NAILS.—A better demand exists for both wire and wire nails and jobbers are specifying heavily. The demand for cut nails is also large and agreed quotations are being firmly maintained despite the fact that they are much higher than those ruling on wire nails. We quote: Wire nails, carload lots, f. o. b. cars, Pittsburg, $1.85 to $1.90; less than carload lots, $1.95 to $2; plain wire, carload lots,

$1.75 to $1.80; less than carload lots, $1.85 to $1.90; barb wire, carload lots, $2.15 to $2.20; less than carload lots, $2.25 to $2.30; staples, carload lots, $2.05, and less than carload lots, $2.15. Galvanizing, 30 cents extra. Cut nails are quoted as follows: Carload lots, $2.05, and less than carload lots, $2.10 f. o. b. Pittsburg, plus freight to point of destination. Terms, 60 days, less 2 percent off in 10 days.

OLD MATERIAL.—Demand for heavy melting stock continues strong and mills are buying heavily. New melting stock is also in big demand but the small tonnage that is being offered on the market is held at almost prohibitive prices. Our quotations, gross tons, are as follows: Heavy melting stock, $22 to $22.50; low phosphorus melting stock, $24 to $24.50; steel rails, $21 to $21.25; re-rolling rails, $22 to $22.50; No. 1 cast scrap, $19.50 to $20; borings and turnings, $11 to $11.50; busheling scrap, $16 to $16.50;; old iron rails, $24.50 to $25.

COKE.—The demand for prompt foundry coke continues strong and sales continue to be made at $6 and $7 at the ovens. For future delivery foundry coke is held at $4.50 to $5 at the ovens and furnace coke is held at $3.75 to $4.50. For the week ending Dec. 13, the production of the upper and lower Connellsville region amounted to about 285,000 tons a slight increase over the production of the previous week.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, Dec. 23.

Increased strength has come to the market in nearly all lines in the closing weeks of the year, this being attributed to the open weather prevailing. The demand for finished iron and steel has been quite active, and pig iron for spot shipment has found many buyers. Prices are firmer than they were a week ago, and there is less disposition on the part of furnaces to sell at the current quotations. Rail mills report orders for several thousand tons of standard sections, and some good sized contracts have been placed for steel bars and structural steel. Merchant pipe, track supplies and wire products are also moving briskly, jobbers and consumers placing orders freely for the spring trade. Furnaces in the South are still suffering from a scarcity of cars, while Western stacks are unable to get all the coke they can use. The scrap market coninues weak and very little buying is being done by mills.

PIG IRON.—Official notification has been made by railroads that the freight rate on pig iron from the Ohio river to points North will be advanced 20 cents a ton on Jan. 1, and will apply on material shipped from that date. The present rate is $2.75 from Birmingham to the Ohio river, and $1.40 from the latter point to Chicago, and when the increase goes into effect, the total freight rate will be $4.35. We have advanced our quotations on Southern iron accordingly. Buying of pig iron during the week has been confined almost entirelv to iron for spot delivery. Prices have stiffened, and No. 2 foundry is selling at $25.15 to $26.15. There is little interest shown in the market for deliveries in the new year, although all sellers agree that prices will advance after the first of January. The firmness of the market may be judged from the fact that an order for 10,000 tons of No. 2 soft and No. 3 foundry, for delivery in January, February and March, which has been offered several firms in the past week, has not yet been placed. There is a good demand for high silicon irons, and for quick delivery 5 percent silicon is offered at $29, and 8 percent silicon at $33.50. No. 2 foundry and soft for delivery in January and February is quoted at $20 Birmingham. For shipment after this date, $18.50 to $19 Birmingham is the general range. We quote prices, Chicago delivery, as follows:

Lake Superior Charcoal	$25 00 to 26 00
Local Coke Foundry No. 1	23 50 to 24 00
Local Coke Foundry No. 2	23 00 to 23 50
Local Coke Foundry No. 3	22 50 to 23 00
Local Scotch Foundry No. 1	24 00 to 24 50
Local Scotch Foundry No. 2	23 50 to 24 00
Southern Coke No. 1	23 85 to 24 35
Southern Coke No. 2	23 35 to 23 85
Southern Coke No. 3	22 85 to 23 35
Southern Coke No. 4	22 35 to 22 55
Southern No. 1 soft	23 85 to 24 35
Southern No. 2 soft	23 35 to 23 85
Southern Gray Forge	22 35 to 22 85
Southern Silveries	26 85 to 27 35
Jackson Co. Silveries	31 00 to 32 00
Ohio Strong Softeners	26 10 to 27 10
Alabama Car Wheel	27 35 to 27 85
Malleable Bessemer	24 50 to 25 00

BARS.—Specifications for iron bars have been in good volume during the week under review, though new business has not been of large proportions. Prices are weak, and sales are reported at 1.75c. A good tonnage has been booked for steel, one large manufacturer reporting an aggregate of 10,000 tons. Inquiries and orders for next year's shipments are growing in volume, while specifications have been better than for many weeks past. There is a good demand for angles, mills being sold ahead two or three months. We quote mill shipments, Chicago delivery, Bessemer steel, 1.75c to 1.85c; angles, less than 3x3, 1.85c to 1.95c base; iron, 1.75c to 1.85c; hoops, 2.15c. Prices on lots from store, steel, 2c to 2.10c; iron, 2.15c to 2.20c; hoops, 2.40c to 2.50c; angles, 2.50c to 2.60c.

SHEETS.—New business is not heavy, demand being mostly for gauges from 16 to 20. We quote No. 27 black, mill shipment, 2.75c to 2.85c; galvanized, 3.35c to 3.65c; for deliveries from stock, No. 27 black, 2.95c to 3c; galvanized, 75 percent to 75 and 5 percent.

STRUCTURAL STEEL.—The tonnage placed during the week has been fairly large, including one order for 8,000 tons, and several lots of from 1,000 tons downwards. We quote mill prices, Chicago delivery, beams, 15 inches and under, 1.75c to 2c; 18 inches and over, 1.85c to 2.10c; universal plates, 1.75c to 2c; angles, channels and tees, smaller than 3 inches, 1.85c to 2c base. On lots from store, cut to length, we quote 2¼ to 2½ cents per pound.

BILLETS.—There have been sales of foreign billets approximating about 3,000 tons. We quote domestic open-hearth billets for forging purposes, $37 to $40, according to tonnage and point of delivery; for use in rolling mills, $33.50 to $34. German basic Bessemer billets are offered at $27.50 to $28, seaboard, duty paid, for round lots—5,000 tons and upward—of one size and one carbon. Special carbons can be had abroad, but bring higher prices according to specifications and quantity.

RAILS AND TRACK SUPPLIES.—Orders for 5,000 to 6,000 tons of standard sections have been placed with Eastern mills by Western roads for such deliveries as mills can give. Demand for track supplies and light rails keeps up. We quote standard sections, $28; second quality, $27; light rails, 45 pounds, $34 to $35; 12 pounds, $40 to $41, with regular differentials for intermediate sizes. Track supplies, mill shipment, are quoted as follows: Angle bars, 2c to 2.10c; spikes, first quality, 2.25c; second quality, 2.15c; track bolts, 3½x¾, with square nuts, 2.85c to 3c per 100 pounds; with hexagon nuts, 3.05c to 3.15c, with usual differentials for other sizes.

MERCHANT STEEL.—New business is very light, mills not desiring to obligate themselves further, being sold up for several months. Specifications are in good volume. We quote mill shipments, Chicago delivery, as follows: Spring steel, 2.65c to 2.75c; sleigh shoe, 1.95c, flat sizes; concave and convex, 2c; out of store, 2.15c; cutter shoe, 2.50c to 2.60c; machinery steel, 2.15c to 2.25c, base; plow steel, 2.50c and upwards according to quality; toe calk, 2.30c to 2.40c; out of stock, 3c to 3.10c; ordinary tool steel, 6c to 7c; specials, 13c and upwards; less than carload lots, 5 percent to 10 percent higher; cold rolled shafting, carload lots, 47 percent off, Chicago; less than carload lots, 42 percent off, Chicago.

MERCHANT PIPE AND BOILER TUBES.—The open weather of the month, permitting building operations to be carried on uninterruptedly, has kept up the demand for pipe, and the leading producer reports that the aggregate tonnage placed is large. There is a good demand for boiler tubes, and prices are without change. We quote f. o. b. Chicago:

MERCHANT PIPE, RANDOM LENGTHS.

	Black. Percent.	Galv. Percent.
⅛ to ⅜ in., inclusive	66½ net	56½ net
16 in.	68½ net	58½ net
¾ to 6 in., inclusive	73½ net	63½ net
7 to 12 in., inclusive	71½ net	61½ net

BOILER TUBES.

Steel.

	Percent.
1 to 1½ in.	48½
1¾ to 2½ in.	56
2¾ to 5 in.	61
6 to 13 in.	58

Iron.

	Percent.
1 to 1½ in.	38
1¾ to 2½ in.	36
2¾ to 5 in.	46
6 inches and larger	36

CAST IRON PIPE.—Manufacturers report that there is little doing, this being the dull season. We quote f. o. b. Chicago,

4-inch water pipe, $36.50; 6-inch, $35.50; 8-inch and upwards, $34.50; gas pipe, $1 a ton higher.

PLATES.—The local mill has its capacity sold as far ahead as July, and the placing of orders for delivery beyond this date is not encouraged. This has deflected a good tonnage to jobbers. We quote mill shipments, Chicago delivery: Tank steel, ¼ inch and heavier, 1.75c to 2c, base; flange steel, 1.85c to 2.10c. Price from stock: Tank steel, ¼ inch and heavier, 2.25c to 2.35c; 3-16, 2.30c to 2.40c; No. 8, 2.40c to 2.50c; flange steel, 2.50c to 2.60c.

WIRE PRODUCTS.—The good movement that has kept up all the month continues, and the local producer reports that its entire production goes into immediate consumption. We quote prices to jobbers, carload lots, Chicago delivery, as follows: Smooth wire annealed, 1.90c; galvanized, 2.20c; painted barb wire, 2.30c; galvanized barb wire, 2.60c; wire nails, $2; cut nails, 2.15c; polished staples, 2.15c; galvanized staples, 2.45c. Prices to retailers are 5 cents higher than above quotations on carload orders, and 15 cents higher on less than carload lots.

COKE.—Shipments into this territory are not of an encouraging volume, and there is a constant demand for spot coke. The Connellsville product is now offered at $9.50 to $10, spot delivery; for forward shipments, we quote $5 to $5.25 at the ovens.

OLD MATERIAL.—The market continues weak, mills not buying anything. The only demand that exists, outside of that for cast scrap, comes from dealers who have sold ahead. We quote gross tons as follows:

The following are selling prices per net ton;

Old Iron Rails	$24 00 to 24 50
Old Steel Rails (mixed lengths)	18 00 to 18 50
Old Steel Rails (long lengths)	23 00 to 23 50
Relaying rails	31 50 to 32 00
Old wheels	22 50 to 23 00
Heavy melting steel	16 50 to 17 00
Mixed country steel	15 00 to 15 50

The following are selling prices per net ton:

No. 1 R. R. wrought	$19 50 to 20 00
No. 2 R. R. wrought	18 00 to 18 50
Shafting	19 50 to 20 00
Dealers' forge	16 00 to 16 50
No. 1 busheling	14 00 to 14 50
No. 1 Cast	16 50 to 17 00
Railway malleable	16 00 to 16 50
Country malleable	14 50 to 15 00
Iron axles	23 50 to 24 00
Steel axles	19 50 to 20 00
Cast borings	10 50 to 11 00
Wrought turnings	13 50 to 14 00
Iron axle turnings	14 50 to 15 00
Steel axle turnings	13 00 to 13 50
Stove plates	12 50 to 13 00
Old iron splice bars	21 00 to 21 50

Pickands, Brown & Co., Chicago, have opened a branch office in the First National Bank Building, at Uniontown, Pa., which will be in charge of their traffic manager, J. J. Armstrong. The firm has experienced considerable difficulty in getting coke shipped on its contracts, and Mr. Armstrong will devote his time largely in minimizing the delays and seeing that the material is sent forward promptly.

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Dec. 24

The year approaches its close with promising indications of prosperity in 1903. Within a few days the number of inquiries for almost all kinds of iron and steel and finished products has increased, and there is reason for believeing that the demand will be strong and that there will be little, if any, lowering of prices in the near future. There are indications that the growing cost of labor will be a factor in keeping prices up. In addition to other increases in wages, the Pittsburg Steamship Co. has this week advanced the wages of all the masters of the vessels of its large fleet 10 percent and it is expected that all vessel employes will be paid as much as they were at the close of the season. This is considered in some quarters to argue for an increase of freight rates for ore. Miners in the bituminous fields will ask an increase of wages beginning April 1, and while their full demands may not be complied with, it is probable that some advance will be granted. Hence the cost of running vessels will be increased. It is also expected that new demands will be made upon blast furnace companies, the agitation of 8-hour turns having been renewed.

IRON ORE.—The official figures on total water shipments for the season do not vary materially from the estimate given in this column last week. They will be found in full in another column. There is a growing feeling that the United States Steel Corporation may consent to a small advance in the price of ore for next year, but nothing positive is known and there have been no conferences to discuss prices.

COKE.—Delivery has improved somewhat. Prices are firmer and as high as $5.25 is now paid for foundry coke for the first half. Some dealers are also asking $5 for the second half, but few contracts are being made at these figures and it is doubtful whether it can be maintained. There is a strong feeling that $5 is too high and that, as new ovens are finished, the price will come down to some extent.

PIG IRON.—The rather surprising amount of spot iron which has recently appeared on the market is exciting the comment from foundrymen who made contracts at much lower prices than those now prevailing. Some of them declare that while their contract iron is not delivered, the firms with which the contracts were made are selling spot iron at high prices. The prevailing Cleveland prices for spot iron are the same as last week, on a basis of $24.75 for No. 1 Northern. No. 2 Southern is selling at $24.20, Cleveland. Very little foreign is sold, and dealers who have been handling it show a disposition to let it alone if domestic can be offered. Complaints concerning Scotch iron not being strong enough continue. The Nova Scotia iron gives better satisfaction. Sales agents have been surprised of late to find how many foundrymen are not fully covered for the first half. Many inquiries are coming in for both first and second half. For the latter, prices are on a basis of $22.75, Cleveland, for No. 1 foundry and $21.75 for No. 2. We quote domestic iron as follows for shipments in the first half of 1903:

Bessemer	$21 75 to 22 25
No. 1 Strong Foundry	23 00 to 23 50
No. 2 Strong Foundry	22 50 to 23 00
No. 3 Foundry	21 75 to 22 25
Scotch No. 1	23 00 to 23 50
Scotch No. 2	22 50 to 23 00
Gray Forge, Valley	20 00 to 20 50
Lake Superior Charcoal	27 50 to 28 00

FINISHED MATERIAL.—Bar iron is somewhat stronger, though reports of cut prices continue. While 1.70c Pittsburg for common is the ruling price in this city for large sales, sales in carload lots have been made at 1.75c and 1.80c and traveling salesmen from Cleveland have made a number of sales in this State and Michigan on a basis of 1.80c, Pittsburg. The price of steel bars, 1.60c for Bessemer and 1.70c for open-hearth, Pittsburg, is maintained, but the market is quiet. The same is true of structural material, on which the delivery is more prompt. A local sale of 5,000 tons is reported for the past week. Plates continue the strongest and sheets the weakest features of the market. Cutting on prices of sheets is still in evidence. The price of the distributors of the product of the principal producer, are as follows: For 3-16-inch sheets and heavier, 2.10c to 2.15c, Cleveland. Mill sales of black sheets, Cleveland, to consumers: No. 24, 2.65c to 2.75c; No. 26, 2.75c to 2.85c; No. 27, 2.85c to 2.95c; and the following prices out of stock: No. 10, 2.35c to 2.50c; No. 12, 2.45c to 2.60c; No. 14, 2.50c to 2.60c; No. 16, 2.55c to 2.70c; Nos. 18-20, 2.75c to 2.90c; Nos. 22-24, 2.85c to 3c; Nos. 25-26, 2.95c to 3.10c; Nos. 27, 3.05c to 3.20c; No. 28, 3.15c to 3.30c. On galvanized sheets we quote mill sales in carload lots, Cleveland, as follows: Nos. 10 and 11, 2.60c to 2.75c; Nos. 12-14, 2.70c to 2.85c; Nos. 15-17, 2.80c to 2.95c; Nos. 18-21, 3c to 3.15c; Nos. 22-24, 3.30c to 3.45c; Nos. 25-26, 3.55c to 3.70c; No. 27, 3.80c to 3.95c; No. 28, 4.05c to 4.20c; No. 29, 4.45c. to 4.60c; No. 30, 4.95c to 5.10c. Galvanized sheets out of stock are quoted 75 and 2½ off.

OLD MATERIAL.—Mills are still insisting on a reduction of about $2 per ton on supplies which they need, but they have not succeeded in pounding the market down. Sales have been limited to absolute necessities so far as mills are concerned. For machine cast scrap there is good demand. We quote Cleveland prices, all gross tons, as follows:

Old iron rails	$25 50 to 26 50
Old steel rails (over 6 feet)	22 00 to 23 00
Old steel rails (6 feet and under)	21 00 to 22 00
Old car wheels	20 00 to 21 00
No. 1 R. R. wrought scrap	20 00 to 21 00
Mill scrap	19 50 to 20 00
No. 1 machine cast scrap	21 00 to 21 50
Iron axles	29 00 to 30 00
Steel axles	28 00 to 29 00

Axle turnings	18 50 to 19 50
Wrought turnings (free from cast)	16 00 to 17 00
Cast borings	11 50 to 12 00
Uncut wrought iron boilers	12 00 to 13 00
Steel boiler plates	17 00 to 18 00
Grate bars	12 00 to 13 00
Pipes and flues (clean)	17 50 to 18 50
Tank iron	17 00 to 18 00
Hoop and band iron	13 50 to 14 50
Sheet iron	12 00 to 13 00
Wrought drillings	15 50 to 16 50
Malleable iron (railroad)	20 50 to 21 50
Malleable iron (agricultural)	17 50 to 18 00
Stove plate	15 50 to 16 50
Heavy steel	19 00 to 20 00

CINCINNATI.

Dec. 23.

No important change has occurred in the iron market during the past week. The coke market has been active with no particular change in prices. Spot coke is quotable at $6.50 to $7.50 at the ovens, while for the first half of 1903 $5.25 to $5.50 at the ovens are the ruling quotations. In finished material prices are unchanged. Some grades of old material are lower.

Pig Iron.—There has been no change in the character of the business in pig iron. Transactions are mainly for spot iron to cover immediate needs. Buyers still maintain a waiting policy as to future requirements. The sale reported last week of 5,000 tons of gray forge for January and February delivery on the basis of $14 Birmingham seems to have been exceptional and has had but little influence on asking prices. It has been stated that $15.50 was bid for gray forge last week without producing offerings, and $16 Birmingham seems to be the minimum figure today. A sale of several hundred tons of No. 3 foundry at $17.50 Birmingham for delivery in the early part of 1903 is reported. This is about 50c a ton below current quotations. For the top grades of foundry iron prices appear to be well sustained, in fact the feeling in the trade is somewhat steadier this week than last. Correspondence in the offices of sales agents indicates a fair demand for current needs and the aggregate of small orders has been better. In regard to deliveries on contracts the situation has shown no particular improvement, but there are many who believe that, with the advent of wintry weather and the consequent lessening of motive power, it will be more difficult to secure prompt and regular movement of iron which will result in disappointments to consumers and will force them to again look to spot offerings to cover immediate wants. Prices for the first half of 1903 are a puzzle, as it is not clear how far consumers are covered by contracts and what proportion of the output of furnaces is sold ahead. The present situation, however, continues to be a waiting attitude on the part of buyers, while sellers regard it as useless to urge their offerings and are not disposed to take contracts below the level of current quotations. These are the surface conditions but it has been intimated that some shading of prices has been going on quietly, although not to an important extent. We quote for quick delivery and first quarter of 1903, f. o. b. Cincinnati:

Southern Foundry No. 1	$22 75 to 23 25
Southern Foundry No. 2	22 25 to 22 75
Southern Foundry No. 3	20 75 to 21 25
Southern Foundry No. 4	19 25 to 19 75
Southern Foundry No. 1, soft	22 75 to 23 25
Southern Foundry No. 2, soft	22 25 to 22 75
Gray Forge	19 25 to 19 50
Northern Foundry No. 1	25 60 to 26 10
Northern Foundry No. 2	24 60 to 25 10
Southern car wheel iron	27 75 to 28 75
Malleable coke iron	25 00 to 25 75

Finished Material.—While there is no buying to cover future requirements there is a fairly good volume of small orders to cover current needs. Prices are unchanged. The undertone is steady to strong and there is some intimation that leading interests will advance prices slightly after the first of the year based on increased freight rates. The liberal run of small orders seems to indicate light stocks and no diminution of consumption, and a good buying movement before the close of January is confidently expected. We quote black sheets No. 27 at 2.75c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 3.20c; No. 27, 3.10c; No. 16, 2.75c; No. 14, 2.65c; No. 12, 2.55c; No. 10, 2.45c. Galvanized sheets, car lots, sell at 75 and 10 percent off; less than car lots, 70 and 10 percent off. Tank plates out of store are quoted at 2.25c for ¼-inch and 2.35c for 3-16-inch. Prices for bar iron in carload lots are: 1.80c base, half extras f. o. b. Cincinnati; steel bars, 1.72c base, half extras f. o. b. Cincinnati. Both are retailed at 2c base, half extras, out of store. Beams and channels are selling 2½ to 2¾c, retail, and angles at 2.15c to 2.25c for base sizes. Merchant pipe and boiler types are quoted as follows for carload lots f. o. b. Cincinnati:

MERCHANT PIPE.

(Basing discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed Wrought Iron Pipe. Black. Percent.	Guaranteed Wrought Iron Pipe. Galv. Percent.
⅛, ¼, ⅜-inch	66.8	56.8	63.8	53.8
½-inch	68.8	58.8	65.8	55.8
¾ to 6-inch, inclusive	73.8	63.8	70.8	60.8
7 to 12-inch, inclusive	71.8	61.8	68.8	58.8

BOILER TUBES.

	Steel Percent.	Iron Percent.
1 to 1½ in.	43.8 & 5	38.8 & 5
1¾ to 2½ in.	56.8 & 5	36.8 & 5
2¾ to 5 in.	61.8 & 5	46.8 & 5
6 to 13 in.	56.8 & 5	36.8 & 5

Old Material.—The market is easier with quotations lower on most descriptions, but old iron axles are scarce and higher. We quote:

Old No. 1 Wrought Railroad, net tons	$19 50 to 20 00
Cast Machine and Foundry, net tons	16 50 to 17 00
Old Iron Rails, gross tons	24 00 to 24 50
Old Steel Rails, gross tons	22 00 to 22 00
Old Short Lengths, gross tons	17 50 to 18 00
Old Iron Axles, net tons	26 00 to 27 00
Old Chilled Car Wheels, gross tons	21 50 to 22 00
Stove Plate, net tons	11 50 to 12 00
Wrought Turnings, net tons	15 00 to 15 50
Cast Borings, net tons	12 00 to 12 50

NEW YORK.

OFFICE OF *The Iron Trade Review*.
Room 1909, No. 150 Nassau St., Dec. 23.

Pig Iron.—The past week in the local pig iron market was the dullest of any in the month, buyers apparently determining not to do any business during the holiday season. "More calendars were received than orders," as one pig iron man expressed it. The little buying was of the "hand to mouth" variety, and on the part of those who had immediate requirements to meet. The dullness was particularly noticeable in foreign irons, of which the only sales we can note were for 300 tons of Middlesboro No. 3, and 500 tons of German iron.

For next year's wants inquiries recently, and especially during the past week, show an increase. Of these inquiries, a goodly portion, we learn from several sources, do not extend beyond the end of the first quarter. A good many buyers must provide for needs in the first half of 1903 and the opinion is generally expressed that the importation of foreign iron will likely continue on a large scale until April 1 anyway. Foreign furnaces as a general rule quote prices for the first quarter of the new year that are a shade lower than those currently reported, and these, by the way, may be said to be the rock-bottom prices of the year. The inquiries are mostly confined to English and German irons, the dearer Scotch irons being neglected.

In domestic irons our advices are that the inquiries never go beyond July 1, and generally before. Buyers appear to reckon on lower prices in the second half, because of increasing production. Southern furnaces report that their sales for the closing six months of the new year are increasing, with Western buyers their chief customers. For this delivery, Southern No. 2 foundry is selling at $18.50, though here and there higher figures are quoted. Southern furnaces are handicapped in deliveries in consequence of a great scarcity of cars. Foundrymen in this vicinity say the coke situation has stiffened of late, with the material itself somewhat scarcer than it has been, and prices higher, generally from $7.50 to $8 at the ovens. New York prices for 1903 are as follows: No. 1 X Northern, $23.25 to $24.75; No. 2 X, $22 to $22.75; No. 2 pl., $21 to $21.75; Southern No. 1 foundry, $23 to $23.50; No. 2 foundry, $22 to $22.50; No. 3 foundry, $21.50 to $22; No. 4 foundry, $20.50 to $21.

Billets.—The market for German steel billets has shown a very strong undertone recently. Prices are irregular, changing every two or three days, and always higher, due, it is claimed, to an increase in German consumption. At this writing, large lots are selling at $27.50 ex-ship. One of the largest importers, with the best of connections, paid this price yesterday.

Finished Iron and Steel.—All departments of the finished

material market were affected by the dullness of the holiday season. During the week, the American Bridge Co. received an order for 2,500 tons for a building in Chicago, and one for 1,000 tons for a building in Pittsburg. The company announces that its new eye bar mill at Ambridge, Pa., formerly Economy, and which has a capacity of 25,000 tons monthly, will be opened just as soon as material can be had. Several large orders for structural material are impending, and will probably be placed early in January at the latest. The situation in the steel plate industry continues active, with each day that passes contributing something to an exceptionally good business for next year. The meeting of steel plate manufacturers, held at the Waldorf-Astoria last Thursday, was largely attended. It was decided to continue in force the price agreements which now exist. Sheets are dull, but prices are held fairly well. Bars are without particular feature. New York prices are as follows: Beams and channels, 15 inches and under, 1.75c to 1.90c; angles, 3 to 6 inches, 1.75c to 1.90c; zees, 1.75c to 1.90c; bulb angles, 2.05c to 2.35c; deck beams, 2.05c to 2.25c; sheared steel plates, tank, 2.10c to 2.15c; flange, 2.25c to 2.30c; fire box, 2.30c to 2.50c; refined iron bars, 1.95c to 2c; soft steel bars, 1.95c to 2.10c; steel sheets, in carloads, New York, No. 28, black, 3.05c to 3.15c; galvanized, 75 and 7½ off.

PHILADELPHIA.

Dec. 23.

Easier money and steadiness in the iron and steel markets have contributed to improve conditions. There is, however, no decided change in the market and none is expected in the near future at least.

Pig Iron.—Good irons are scarce, but there is little difference in the price for spot and for delivery during the first half. Prospects for next year are favorable, but it is not certain that the volume of business will be as large as during 1902. Prices are just 50 percent higher than they were a year ago. Firm quotations are being made on domestic irons on six months' contracts, with no pressure to sell. Foreign iron shows a tendency to decline and a fair quality of foreign can be laid down on wharf, duty paid, at $17.50 in cargo lots. Prices for cargo lots of Middlesboro No. 3 are $17.50; for German, $19.50 to $20. American is on a basis of $24 to $25 for No. 1 X foundry.

Finished Material.—Business is in a satisfactory condition. On account of the scarcity of coal, mills are not making full output. Holiday suspension will probably be longer than usual. We quote as follows: Plates, small lots, 2.10c to 2.15c; carload lots, ¼-inch and thicker, 2c to 2.05c; universals, 2c to 2.05c; flanges, 2.10c to 2.20c; firebox, 2.25c to 2.30c; marine, 2.30c to 2.35c. Steel bars, 1.80c to 1.85c; prompt shipments, Western steel, 1.75c to 1.80c; bar iron, 1.92c to 1.95c for carload lots. In structural material, next year's deliveries are quoted at 1.72c to 1.80c, but for prompt shipments large sizes command all the way from 1.90c to 2.10c.

Old Material.—The market is dull, but prices are holding up and there is little change. We quote as follows: Old steel rails, $20.50 to $21.50; miscellaneous heavy steel scrap, $20 to $20.50; low phosphorus scrap, $26.50 to $27.50; old steel axles, $25 to $26; old iron axles, $28.50 to $30; old iron rails, $24 to $24.50; old car wheels, $20 to $21; choice scrap R. R. No. 1 wrought, $22 to $23; country scrap, $20 to $21; machinery cast, $19.50 to $20.50; No. 2 light scrap (forge), $18 to $18.50; No. 2 light scrap (ordinary), $14 to $15; wrought turnings, $16 to $16.50; wrought turnings, choice heavy, $16.75 to $17; cast borings, $10 to $10.50; stove plate, $14 to $15.

BIRMINGHAM, ALA.

Dec. 23.

With the approach of the new year there is a slackening in the demand for iron and sales have been rather light the past week. Barring a reported purchase of 5,000 tons of gray forge, no transactions of any moment have come to light. This sale of gray forge was reported to have been made by a Southern iron maker, but persistent inquiry has failed to locate the seller. The price was said to have been much lower than what has been considered the ruling price for that grade. Small sales of No. 1 foundry have been noted at prices ranging from $21 to $23, while No. 2 foundry has brought practically the same prices. Mottled and forge in a few sales of 100-ton lots have brought $16.50 and $17, f. o. b. cars at Birmingham. The Williamson furnace is again making iron, and the close of the year sees practically every iron furnace in the district worth considering in operation. The Woodstock Iron Works blew in their new 200-ton furnace the past week. The new furnace of the Central Iron Co., at Holton, near Tuscaloosa, is expected to be in operation within the next few months. While the holidays will probably more or less affect the output this week, it is understood that the coal miners will take a much shorter vacation than usual, and that supplies of raw material will not be very much shortened.

Coke continues in active demand at what might be considered fancy prices, while there are urgent appeals from all sources for more coal, both steam and domestic. Higher prices for coal are being paid this winter than known here before.

Capt. J. M. Elliott announces that he has bought the St. Louis furnace and will remove it to Gadsden, Ala., where he will materially enlarge it, so as to make it the largest furnace in the South. The height is to be 99 feet with a bosh of 20 feet. Capt. Elliott has recently closed deals for some large bodies of ore and coal lands in the Gadsden territory, and is buying this furnace with a view of utilizing the product of the mines now being opened thereon. It is stated that J. H. Hardin, who has resigned as local manager of the Southern Car & Foundry Co., may superintendent the new furnace.

John Dowling, for many years identified with the interests of the Tennessee Coal, Iron & Railroad Co., and for the past 12 months superintendent and general manager of the Lacey-Buck Iron Co., has accepted the position of engineer of construction for the Valley Iron Co. This company is building a modern furnace at Battelle, Ala., where it has recently let contracts for the erection of 300 coke ovens.

The Southern Bolt & Nut Co. has been acquired by the American Bolt Co., of Lowell, Mass., and will erect a new plant at East Birmingham.

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM NO. 1909, 150 NASSAU ST., Dec. 23.

Pig Tin.—At our last writing, the tin market was developing great strength, and for a time it looked as if substantial additional advances would result. Prices all of a sudden took a downward tendency, reaching the lowest price on Friday, when spot sold at 25.57½c. Since then the market has recovered a little, and is now almost as strong as when the highest prices of the bull movement were reached. In London, the past week, the market was very strong, spot selling as high as £118 7s 6d, due to manipulation by a leading operator. This had little or no effect either on prices or business here, the latter still being restricted to meeting current wants. Latest London quotations for spot show a decline, but nevertheless they are 15s 6d higher now than a week ago. Today's closing prices at the metal exchange were as follows: Spot, 25.95c to 26.05c; January, February, and March, 25.75c to 26.05c. London closed today as follows: Spot, £117 15s; futures, £118 2s 6d. Arrivals at Atlantic ports to date amount to 2,192 tons, with 2,095 tons afloat.

Copper.—Dullness was again dominant in the copper situation. While there have been no transactions on the metal exchange during the week, cargo lots of Lake have sold in the outside market for 11⅝ to 11¾c, and cargo lots of casting at 11½ to 11⅝c. Buyers are out of the market, and apparently are waiting for the publication of the annual statistics, which are expected to reach the "street" by Jan. 10. These always have a marked effect on values. Their publication last year was followed by copper declining from 17c to 11c. While no such sensational drop is expected from the forthcoming statistics, gossip all seems to tend toward lower prices following public consideration of them. As compared with last week, London closing quotations today are higher, but they show a decline from the highest prices of the week. Wall Street news agencies tell of a trade understanding having been reached be-

tween the Amalgamated, Heinze, and Calumet and Hecla interests, and the abandonment of the litigation now impending between the Amalgamated and Heinze people, but in copper circles no credence whatever is placed in the announcements, which are thought to have been made solely for stock-jobbing purposes. Today's closing prices at the metal exchange were nominal, and were as follows: Lake, 11.65c; electrolytic and casting, 11.45c; standard, 10.75c. Closing prices today in London were as follows: Spot, £51 7s 6d; futures, £51 16s 3d. Exports for the month to date aggregate 6,697 tons, and from present indications the exports for December will be the smallest of any month for the year.

PIG LEAD.—No change here, lots of 50 tons or more selling at 4.12½c. In St. Louis, the market is slightly lower, spot being quoted at 3.95c to 3.97½c. In London, values are a shade easier at £10 16s 3d.

SPELTER.—There has been no abatement in the downward tendency during the week, and spot is 10 points lower than at our last report. Futures have also declined in proportion. Spot today is quoted at 4.80c, December, 4.75c, and January, 4.70c. An ease in values is noted in the St. Louis market, spot now being 4.50c. London is unchanged at £19 17s 6d.

ANTIMONY.—All brands continue easy, with Cookson's at 8½ to 8¾c, Hallet's, 7⅞c to 7⅜c, and other brands at 6¾c to 7c.

NICKEL.—Unchanged. Prices average 40c to 60c, according to quantity.

QUICKSILVER.—Jobbers only are in the market, and sales have been made on the basis of $48 per flask in lots of 100 flasks. London, £8 15s.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, Dec. 23.

There is no change to be noted in the metal market. Demand is only fair. We quote jobbers' prices as follows:

Lake copper, carload lots, 11⅞c; less than carload lots, 12c to 12¼c. Pig tin, 26¼c; pig lead, carload lots, 4.05c to 4.07½c; less than carload lots, 4.10c. Sheet zinc, carload lots, 6¼c, and 6⅜c in lots of 600 pounds. Spelter, carload lots, 5c; less than carload lots, 5¾c to 6c. Antimony, 10¾c to 11c for Cookson's, and 9¾c for Hallett's in small quantities. Nickel, 50c to 60c, according to size of order and delivery. There is little demand for old metals, and prices irregular. Selling prices of dealers are as follows: Copper wire, $10.25; heavy copper, $10.25; light copper, $9.25; red brass, $10.25; yellow brass, $7.75; light brass, $6.50; lead pipe, $3.90; zinc, $3.75.

Highest Head of Water for Turbines.

The *Engineering Record* prints an article from *Le Genie Civil* descriptive of a power plant with a high head of water. The plant is located at Vonvry, Switzerland, and the water is taken from Lake Tanay which has an elevation of 4,645 feet, while the turbines at Vonvry have an elevation of 1,528 feet; this being equivalent to a hea dof 3,117 feet. The lake has a good watershed and is large enough to give a generous supply of water; the present project is to develop 10,000 horsepower, just one-fifth the total contemplated power.

The water is led from the lake by a tunnel some 900 feet long into sheet steel pipes laid below the frost level in trenches for a distance of over 6,000 feet to the power house. The pipes subjected to heavy pressure are welded tubes of Siemens-Martin steel jointed by bolts through loose rings held by flanges on each section. The actual pressure attained at the lower part of the conduit is something over 1,000 pounds per square inch. The turbines are of the Pelton type, constructed of cast iron discs carrying curved cast iron blades on both sides near the rim. Each is supplied with two nozzles, one of which is fixed and the other capable of regulation. The nozzles each have two converging orifices corresponding to the sets of blades on the two faces of the wheel, which is mounted on the alternator shaft and runs at 1,000 revolutions per minute. The alternators produce a single-phase current at about 6,000 volts pressure with a frequency of 50 cycles per second.

For an installation of such size this plant is claimed to use the highest head of all water power developments yet attempted.

SALE OF THE CHAMPION MINE.

The Champion iron mine in Marquette county, Michigan, one of the most famous of old range properties, has been purchased by the Clairton Steel Co., of Pittsburg. While the purchase price is not known exactly, it is understood to be a little above $2,000,000. The mine is the last of famous old range properties on the market and several interests have been figuring on its purchase, among them the United States Steel Corporation. The ore of the Champion is for the most part a specular and required crushing to put it in shape for the market. Its hardness and its phosphorus content have made it somewhat slow on the market, but it is an excellent ore for the manufacture of basic pig iron, which is the use to which it will be put in the practice of the new owners. There are three grades of ore from the Champion. The Champion No. 1 crushed runs 64 in iron, .060 in phosphorus, 4.55 in silica, .20 in manganese, 2.38 in aluminia, .32 in lime, .29 in magnesia, .013 in sulphur and .80 in moisture. The Champion B crushed has 60.30 in iron, .058 phosphorus, 8.96 silica, and .95 moisture. Champion hematite runs 52.25 in iron, .397 in phosphorus, 9.84 in silica, 1.67 in alumina, 3.16 in lime, 1.81 in magnesia, and 8.60 in moisture.

The Champion is one of the great mines of the Marquette range. It was opened in 1868, being then the most westerly on the range. Its largest output was in 1890, when 223,442 tons went to market. In 1899, the output was 215,074 tons. The total output up to the close of last year was 3,815,476 tons. The mine suffered severely during the depression of 1893. The Mesabi mines were attracting attention and seemed so much more promising than the Champion that it was proposed to take out the magnificent plant of machinery and transfer it to some Mesabi mine, but other counsel prevailed. A fine crushing plant was installed and all the ore was crushed. Shipments were made from stock in 1893 and 1894, the mine not being in operation. In the spring of 1895 work was resumed in part. In the following fall, the western part of the mine was unwatered and regular running was resumed in the spring of 1896. Mining has since been continued steadily, the average output being about 135,000 tons The lowest workings are about 1,500 feet from the surface. The deposit is a true vein and the dip is nearly vertical. In the central part of the mine, a large barren area was found. The most westerly shaft is about 2,400 feet from the most easterly. The walls in the west end are remarkably stable and the ore is entirely removed, no supporting pillars being needed. The mine makes little water. Walter Fitch is agent and superintendent. The Champion has long been owned by the Champion Iron Co., a Boston corporation, of which Henry H. Fay, of that city, is president, W. E. Stone, treasurer, and W. B. Bosson, secretary. Since 1879, H. H. Brown & Co., Cleveland, have been agents for the sale of the ore.

A National Tube Co. Change.

A. S. Matheson, third vice president of the National Tube Co., in charge of the export department, with headquarters in New York, has tendered his resignation to become effective on Jan. 1. With the resignation of Mr. Matheson the office of third vice president will be abolished and the export offices will be removed to Pittsburg, where they will be combined with the general sales department. Mr. Matheson retires to private life after a most successful career in the pipe and tube trade. He was superintendent of the National department of the National Tube Co., at McKeesport, Pa., for several years and was later elevated to the position of third vice president for the purpose of establishing the export department which has flourished under his management.

The Charles G. Smith Co., 347 Fifth Ave., Pittsburg, has had a very successful year in its business. It now announces the closing of arrangements to represent the Springfield Machine Tool Co., of Springfield, O., so that in addition to its present lines it will be in position to sell engine lathes from 14 to 42-inch swing, turret lathes and chucking lathes, shafting lathes, brass finishing lathes, crank shapers, gear shapers, power presses, bench presses, and shaft straightening machines.

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THE IRON ORE SITUATION.

The winding up of another season of Lake Superior ore shipments brings before iron manufacturers anew the questions of supply, demand and price in connection with this foundation industry. All early estimates of the ore movement made by those in position to know closely of the needs of the blast furnace interests depending on Lake Superior for their ore supply, have been exceeded. The shipments by water have reached the unprecedented total of 27,039,059 tons, as against 20,149,669 tons shipped by lake in 1901. All-rail shipments will carry this season's total close up to 27,500,000 tons, or 7,000,000 tons more than the total shipments from Lake Superior iron mines in 1901. This increase is about equally divided between the United States Steel Corporation mines and those outside the corporation. In 1901 the steel corporation mines shipped 12,459,211 tons. This year their total will be about 16,000,000 tons—an increase of substantially 3,500,000 tons.

It is well known that an increase of 7,000,000 tons in the shipments of Lake Superior ores in 1902 over 1901 is not called for by the increase in the use of these ores in the furnaces depending upon the iron mines of the Lake district. It is true that Eastern furnaces have used more Lake ores the past year than ever; also that a new movement has developed in the year in the shipment of 200,000 to 300,000 tons of these ores into Virginia, low freight rates combining with the high iron content, as compared with native ores, to make this arrangement attractive to Virginia furnacemen. But all the new sources of demand cut a small figure when compared with the sharp restriction of ore consumption due to the coke famine of 1902 in the very heart of the furnace districts tributary to the Lakes. If, as now seems likely, there shall be an increase of pig iron production in the country in 1902, of about 1,900,000 tons over the record of 15,878,354 tons in 1901, it will be seen that the Lake Superior ore consumption, if we credit all the increase to districts using Lake ores, has been not more than 3,500,000 tons more in 1902 then in 1901.

It is plain, even with such increase in output of Northern furnaces as may come in the next four months, that the opening of the season of navigation in 1903 will see far the largest stocks of ore on Lake Erie docks and in furnace yards that have ever been known. Not a few consumers will have ores enough on hand to run their furnaces into July or August. The steel corporation's surplus will evidently be large—an ample safeguard against dock, vessel or mine labor troubles for a period of fully three months after the beginning of the navigation season. Those who have applied simple proportion to the statistics of the ore industry and calculated on the same relative increase in 1903 that has been made in 1902, are sure to be disappointed. The movement of next year is not likely to be more than this year; it may not be as great, unless the policy prevails of maintaining a larger factor of safety than has heretofore been thought necessary, in the stocks carried on Lake Erie docks.

An interesting feature of the ore movement of the past three years is the distinct gains made in the percentages of Mesabi ores that have gone to market. The following table shows the percentage furnished by the new range from the year 1893. The figures represent gross tons:

Year	Mesabi	Total	Percent
1893	613,620	6,065,716	10
1894	1,793,052	7,748,312	23
1895	2,781,587	10,429,437	26
1896	2,882,079	9,934,828	29
1897	4,275,809	12,461,574	34
1898	4,613,766	14,021,673	32
1899	6,626,384	18,251,804	36
1900	7,809,535	19,121,893	41
1901	9,004,890	20,737,522	44
1902 (approx.)	13,290,000	27,400,000	48.5

In the earlier years 25 percent of Mesabi ores in a furnace mixture was the average that it was believed could be safely handled. This increased later to about one-third. As new properties have been opened up and the percentage of lumpy ore on the Mesabi range has increased, the proportion used in the furnace has grown. The shipments this year, it will be seen, amount to very nearly one-half of the total, the figure 27,400,000 including an estimate for all-rail shipments not yet determined.

The question of prices of Lake Superior ores for 1903 has not been seriously taken up as yet. A meeting of the ore interests will probably be held at an early day, now that the statistics of production of the various grades of ore have been collected by the various companies. The attitude of the United States Steel Corporation is naturally an important factor, even though the corporation sells no ore whatever on the market, though it is carrying out the long-time contracts of ore companies it absorbed. From some of the merchant ore companies there has come an intimation recently that some advance is due, in view of the low price of ore in the past year, as compared with that of pig iron. Following out its declared position respecting prices of finished products, the steel corporation is expected to favor a conservative policy in ore prices. Counting its ore reserves as an asset of such importance as official

statements have indicated, it might naturally consider that consumers should pay roundly for Lake Superior ore. Yet neither mine-owning steel companies nor merchant ore interests have at any time favored a drastic policy and iron mines are never likely to show such a scale of profits as often appears on pig iron, steel and finished material.

The possibility of an agreement on prices of Mesabi ores and the non-Bessemer ores of the old ranges, will no doubt be canvassed again. Last year merchant ore interests made no serious attempt to reach an understanding on anything but old range Bessemers, some unsatisfactory experiences on a previous agreement that took in all ores operating against another effort. It would seem that the entire ore situation in the next decade will turn on the policy pursued by the United States Steel Corporation in the effort to guarantee a continuous dividend paying record on its mass of securities. Appraising its ore reserves at $700,000,000 indicates an expectation of a time when its control of the Lake Superior product will be more complete than it is today. If competition for ore properties continues as it has been in the past two years, in the effort of outside producers to guard their future, we may expect such prices for ore as to make certain that the day of $10 pig iron and $14 steel shall not come again.

As indicating the extension of the by-product coke industry the following exhibit is interesting. It shows in one column the extent of original plants built in connection with blast furnaces and the present plant, or that which the completion of construction now under way will give:

	Original.	Present.
Cambria Steel Co.....	60 ovens	260 ovens
Riverside (Wheeling, W. Va.).	60 "	120 "
Ensley, Ala.	120 "	240 "
Dunbar, Pa.	50 "	110 "
Dominion Iron & Steel.....	400 "	500 "
Nova Scotia Steel	40 "	80 "

H. C. Frick Co. Advances Wages.

(Special Telegram.)

PITTSBURG, Dec. 24.—The Frick Coke Co. advances its miners exactly 8 percent and others approximately the same. The following notice will be posted late tonight: "On and after January 1, 1903, until further notice the following wages and prices will be paid for labor by this company: Mining and loading room and rib coal, $1.35 per 100 bu. Mining and loading heading coal, $1.50 per 100 bu. Mining and loading wet heading coal, $1.55 per 100 bu. Drawing coke per 100 bu. charged, 77 cents. All the above by same measurement as at present. Drivers and rope riders (shafts and slopes) per full run, $2.50. Drivers and rope riders (drifts) per full run, $2.40. Cagers per full run, $2.50. Track layers, blasters and timbermen (shafts and slopes) per day, $2.50. Track layers, blasters and timbermen (drifts) per day, $2.40. All day labor not mentioned above regularly employed in the operation of the plants now receiving $2 and over per day, to be advanced 15 cents per day, and all receiving less than $2, to be advanced 10 cents per day. Leveling per oven, 12½ cents. Forking box and stock cars and forking open top cars from yard, all to be advanced 15 cents per car over present price. Payments, semimonthly, same dates as heretofore.

"H. C. FRICK COKE CO."

N. & G. Taylor Co., of Philadelphia, whose lease of the Maryland Sheet & Steel Co.'s plant at Cumberland, Md., was noted in our last issue, furnish some additional details. The lease takes effect Jan. 1. The property comprises open-hearth furnaces, plate mills, sheet mills, foundry and a department for the manufacture of harrow discs. The lessees will operate the works on a more extensive scale, doubling the output of sheets and washers and expect in the near future to add one or more open-hearth furnaces of sufficient capacity to also supply the black plate mills adjoining this property with all the tin bars they use and for this purpose will put in a new bar mill. James B. Strawbridge, who for many years has been the general superintendent of the various steel works at Middletown, O., will become general superintendent of the Cumberland plant on Jan. 1. N. & G. Taylor Co. has been running its black plate mills uninterruptedly and continuously for the last three years, supplying its tin plate works at Philadelphia, and has in contemplation the adding of two more mills, giving a ten-mill plant and necessitating the addition of corresponding finishing ends. The company will employ some 800 men in the two plants, the pay roll running close to a half million dollars a year, with an output reaching nearly 50,000 tons annually of different products. The tin plate works in Philadelphia are very complete, using 26 tinning stacks, and the entire plant is a model of its kind. The well known "Old Style" brand of roofing tin is the chief product.

The Jones & Laughlin Steel Co. will open branch offices in the Arcade Building, Philadelphia, on Jan. 1. No stocks will be carried, but the new office will be made a district sales office, handling the Philadelphia and contiguous territory, including Baltimore, Washington, Norfolk and Richmond. The office will be in charge of F. M. Campbell, who has been looking after trade in Western Pennsylvania and Eastern Ohio for the company. This is in line with the general policy which the company has followed for years of getting as close to the trade as possible.

The Union Coal & Coking Co., of New York City, has recently purchased 3,200 acres of coal lands, in McDowell county, W. Va., on the projected line of the West Virginia Central Railroad, a part of the eastward extension of the Wabash system. The company will shortly erect 1,000 coke ovens. The original capitalization was $10,000,000, which the directors recently reduced to $2,500,000. William J. Le Pine, of Brooklyn, is president.

Prof. R. A. Allen, of Cornell University, in giving some results of tests on liquid air engines summarizes as follows: "The expenditure of 1 horsepower continuously for 1 hour results in the production of enough liquid air which, if utilized in its turn as a source of power in a perfect machine, would produce 1 horsepower for 1 minute. The most efficient method of obtaining liquid air yet discovered would increase this last period of time to 5 minutes." This means that the best efficiency obtained is but about 8 percent of the energy expended.—[Sibley Journal.

Announcement was made at Pittsburg this week of a reorganization of the Pressed Steel Car Co. sales department. O. C. Gayley, brother of James Gayley, of the United States Steel Corporation, has been made manager of sales in the Eastern District, at New York. C. E. Postlewaite becomes manager of sales of the Central District at Pittsburg, and J. H. Mitchell becomes manager of sales of the Western District at Chicago. F. H. Rapley, resident engineer at London, becomes assistant to the president.

A Schenectady, N. Y., dispatch of Dec. 22, says: "General Manager Emmons, of the General Electric Co., today announced that Edward Utting would not be reinstated in the employ of the company. His reinstatement was asked for by the international officers of his union, and an agreement was made that, in the event of his reinstatement, the men would not strike and he would not take his position. The company was to agree not to declare a lockout. Utting was discharged for being absent for nine days without giving notice to his foreman. He was organizing employes of the company at Lynn, Mass."

A NEW POWER TRUCK.

Perhaps the single feature of the power truck which is most attractive to the mover of heavy goods is the fact that the unwieldiness of a self-propelled vehicle does not increase with its capacity, as does that of the horse-drawn carriage. There are many cases where a single piece of material, for instance a large block of stone, weighing many tons, has to be moved over ordinary roads; and there, of course, clumsiness has not been considered, since heretofore there has been no alternative. But where the load is made up of pieces weighing up to a couple of tons, nothing larger than a four horse hitch is used, and often two two-horse teams are run in preference to one four, because of the greater ease with which they can be handled. Yet, all other things being equal, and with a full load, the cost of hauling a ton of goods a given distance will be less with a four than with a two-horse truck. The tonnage of the truck is doubled, whereas little save the cost of horses and harness would be increased by more than half.

It is claimed and the assertion is supported by figures obtained from actual practice that, under similar circumstances to those governing the case of the ordinary four-horse dray, goods can be carried more cheaply by a power truck of the same capacity. If the trucks are run ten hours a day, as against seven, the cost is decreased nearly half, and if they are run twenty hours a day, the cost is decreased by two-thirds. There is at the present time, ready to lay before the public in connection with the machine shown, a system of interchangeable bodies, by the use of which the cost can be again cut in two, simply from the saving of time. The following comparison of the cost of haulage by horses and by motor trucks is submitted by the Morgan Motor Co.:

Cost of Haulage by Horses.

Four horses at $200	$ 800 00	
Teams at $500	500 00	
Harness at $50 per horse	200 00	
Blankets at $1.50 (2 sets)	12 00	
Stable extras, brushes, harness dressing, etc.	25 00	
Cost		$1,537 00
Depreciation 10% per annum of vehicle	$ 50 00	
" 25% " " horses	200 00	
" 25% " " harnesses	50 00	
" 100% " " blankets	12 00	
" 100% " " brushes, etc	25 00	
Total Depreciation		$ 337 00
Wages		1,300 00
Feed (365 days)		730 00
Shoeing	$ 350 00	
Veterinary Services	100 00	
Maintenance of vehicle	75 00	
Maintenance of harness	20 00	
Total Maintenance		545 00
Interest on Investment at 5%		61 85
Insurance at 1½%		21 55
Cost to operate		$2,995 40

Assume that a four horse team travels a total of 15 miles uer day, and that a load is supplied only one-half the time, or, in other words, that there are 7½ carrying miles. With a load of seven tons, the ton mileage is 52½. This multiplied by the available days in the year, which may be taken as 275, gives a yearly ton mileage of 14,437. The yearly cost to operate divided by this figure gives the cost per ton mile as $.208.

Cost of Haulage by Motor Trucks.

Cost	$7,500 00
Depreciation at 15 percent per annum	$1,125 00
Interest at five percent	375 00
Insurance at 1½ percent	112 00
Wages	1,300 00
Fuel (275 days)	770 00
Lubricating oil at 50 cents per day	187 00
Spirits and waste	50 00
Maintenance and repairs	300 00
Cost to operate	$4,219 00

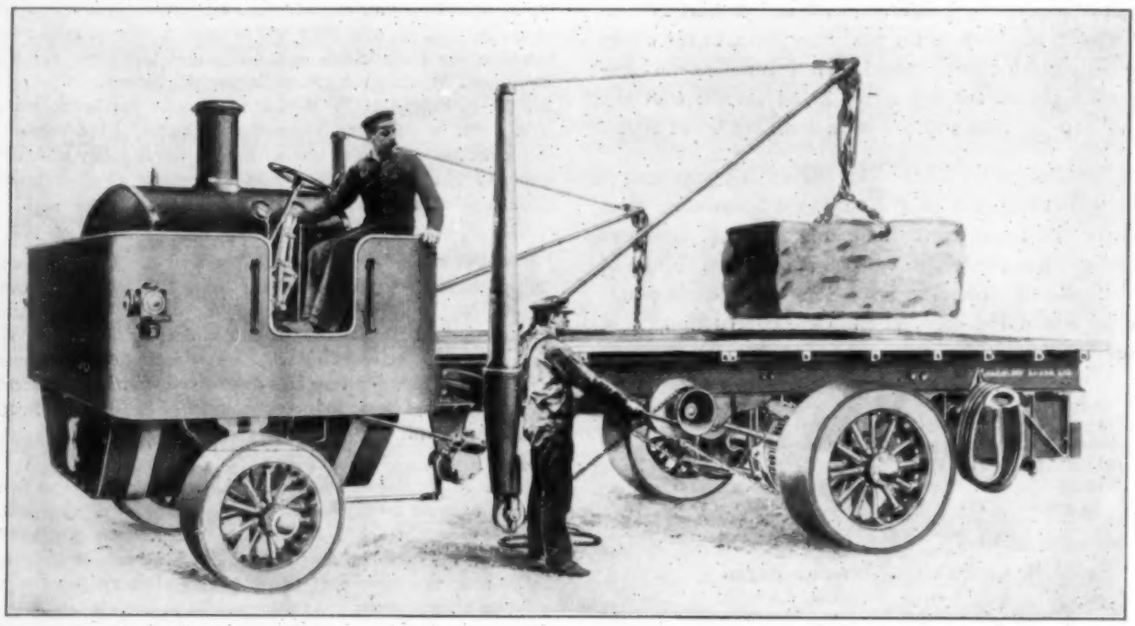


FIG. I.—TEN TON AUTOMOBILE TRUCK BUILT BY THE MORGAN MOTOR CO., WORCESTER, MASS. HOISTING LOAD BY ITS OWN POWER.

Assuming in this case that the machine runs 40 miles per day, of which as above only one-half the distance is covered with a load, the total ton mileage will be 200. This multiplied by the 275 days gives a total ton mileage of 55,000. Dividing the yearly cost to operate by the yearly ton mileage, the cost per ton mile of $.0767 is obtained.

The estimate is made on the basis of the trucks being worked under as nearly as possible the same conditions that would influence the working of a four-horse team. There is no working day and night, and there is no taking into consideration the fact that, whereas the truck is good for a full load during its entire running time, horses get tired, and will hardly draw the load or make the time towards the end of a day that they will at the beginning. As given, the cost of haulage by the truck is $.0767 per ton mile, as against $.208 per ton mile, the cost of haulage by horses. With the interchangeable body system the cost of motor trucking is not over a half of this, or $.0383 per ton mile. If the truck is run twenty hours a day, it will, of course, cut the cost on the interest and insurance, while the wages, fuel, lubricating oil, etc., will be practically as much for the night as for the day.

The engineers of the Morgan Motor Co., of Worcester, Mass., as they proceeded further with the manufacture of

trucks, were impressed with the fact that nearly nine out of ten concerns, with whom they had correspondence upon the subject, wanted a truck which would carry from six to ten tons. As a result, they have designed and built a ten-ton steam truck which is now in successful operation. This is

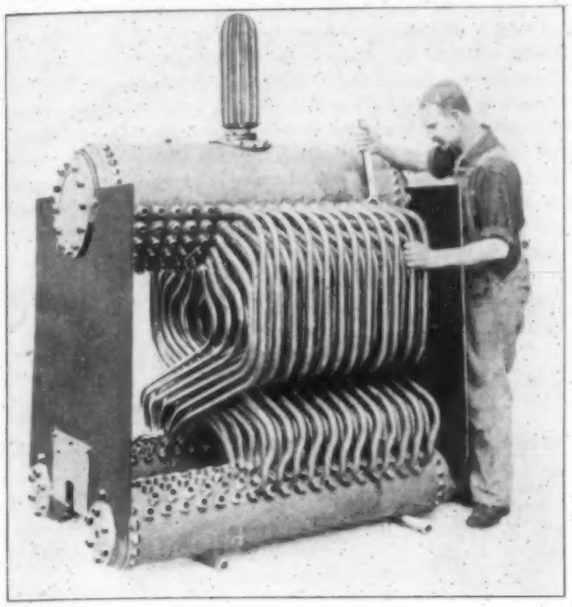


FIG. 2.—WATER TUBE BOILER OF MORGAN TRUCK.

shown in Fig. 1. Six-ton trucks of like design and similar proportions will be built upon order. The general dimensions of the Morgan ten-ton truck are as follows: Total length, 22 feet 5 inches; total width, 7 feet. The loading space is 16 feet 10 inches long, and has a total loading area of 118 sq. ft.

What may be called the foundation of the truck is formed by two 9-inch I-beams. These are tied together with 3-inch I-beams for that part of the frame which carries the loading platform, by two 3-inch channels in front of, and 7 inch I-beams behind, the boiler and also by the boiler suspension, and two 6-inch deck beams over the rear axle.

The boiler, Fig. 2, is of the water tube type, the design corresponding somewhat to torpedo boat practice. The steam drum and the two mud drums are of extra heavy steel tube, and have at each end large hand holes, so that the entire boiler may be easily cleaned. These drums are connected by one inch seamless drawn steel tubing, the joints being of a special design to facilitate replacement of tubes. In case a tube gives out, and there are none on hand for repairs, each opening may be effectually closed by the insertion of a flanged plug. There is a dome above the steam drum which thoroughly dries the steam before it is taken to the engine. The whole is encased in a double steel jacket, with a 1-inch lining of fire felt next to the flame, and a ½-inch porous asbestos lining between the shells. As a point of convenience, it may be noted that by breaking the steam and water connections and removing four bolts, the entire boiler may be lifted bodily from the truck. The outer shell also is arranged with the idea of making access to the boiler as easy as possible.

The boilers are given a cold water test of 600 pounds and a steam test of 300. The safety valve, which is of locomotive pattern, a muffled pop, is set at 225 pounds. The working pressure is 180 pounds. Water is supplied to the boiler by a power pump geared to the engine, the amount being regulated by the usual bypass. Either fuel oil or kerosene may be used for generating the steam. The two burners are easy of access, and may be drawn out together by the disconnecting of a single joint. They may be reached either from the front or from the rear. The oil is not carried under pressure in the tanks, but is forced into the burners by a small pump which is geared to the machine.

The engine seen in fig. 3 is a double tandem compound, with the cranks set at 90 degrees. This type the makers consider superior to that of the cross compound engine ordinarily used on such machines, in that it is at all times possible to start the truck from a stand and without reversing. The crank shaft and the main gear are formed of a single solid piece of steel. The working parts are enclosed in an oil tight case from which the cylinders are separated by an intermediate frame. This renders it easy to change the piston and valve rod packings and also prevents the steam from passing from the cylinders to the crank case and there condensing. By a special throttle it is possible to admit live steam to the low pressure cylinders, thus very nearly doubling the power of the engine. The steam passes from the engine to a combined feed water heater and separator and the water of condensation is returned to the water tank and whatever steam may be left passes into an exhaust head of special design in the space over the boiler and is burned up.

The oiling of the various parts of the engine and transmission is taken care of by a small power pump, oil being drawn from the lowest point of the case and carried through small copper tubes to the various bearings. This system of forced lubrication drives a stream of oil constantly about each bearing.

The transmission gear is also entirely enclosed and runs in a bath of oil. Nothing but spur gears are used throughout the truck. Two ratios of gearing are provided; with one the engine makes ten revolutions to one of the driving wheels, and with the other twenty. The slip gears are on an intermediate shaft between the engine and the main sprocket shaft, the compensating gear being on the latter. The engine and transmission gear are in a single case, which is suspended at three points. The cylinder end of the engine is connected to the frame by a pivot joint and the other two points of suspension are in the ball and socket bearings of the intermediate shaft, which are riveted to the main I-beams. This method of suspension prevents any strains in the frame being communicated to the engine or the transmission gear. The power is carried from this shaft to the rear axle by two 5-inchx1½ pitch silent chains. The large sprockets are bolted to drums or quills. One quill is cast on to the rear axle and the other is a running fit upon it. Each quill carries a 5½-inch hub, over which the rear wheel is slipped and made fast. The outer rims of each of these quills form brake drums, upon each of which act two shoes, which are controlled by a small steam cylinder. The brake is very powerful and is double acting. Throughout the transmission, the use of keys has been avoided wherever possible.

The entire rear axle construction is especially heavy and

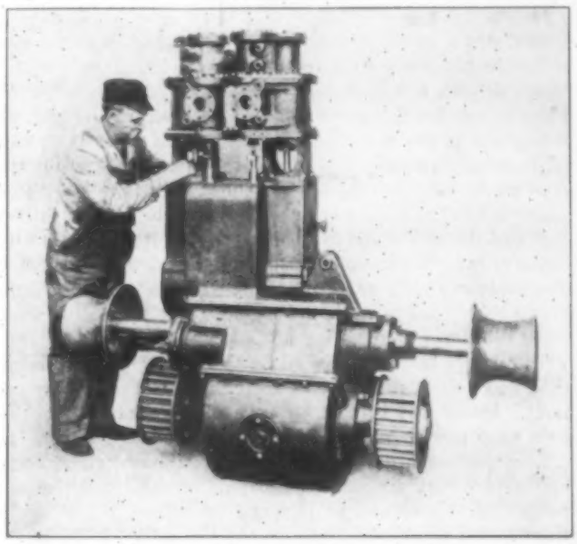


FIG. 3.—TANDEM COMPOUND ENGINE OF MORGAN TRUCK.

is shown in Fig. 4. It is not in two parts, the quill construction leaving the rear wheels free to act separately. The axle itself revolves in two 5½-inchx11-inch bearings, which in turn support the rear springs. These and indeed all the exposed bearings on the truck are well protected from dirt.

Special care has been given to the design of a wheel which will withstand the roughest usage. The hubs are very large, and the spokes are of steel. There are two metal tires between which are wood felloes. The rear wheels are fitted with 12-inch steel tires, which give nearly 2 inches of tire surface for every ton of load carried. The front wheels have 7½-inch tires. The pulling strain of the engine is taken off the rear springs by struts which are braced against the two 9-inch I-beams. The front axle, which is under the center of the boiler is of 4-inch stock, and supports the main frame on pedestals. Helical springs are here used. The pivot axles are of nickel steel.

The oil tank, which holds 80 gallons, is underneath the body of the truck, just back of the boiler. It is made of 3-16-inch sheet steel. Under ordinary circumstances the tank will hold enough to carry the truck from 30 to 40 miles. There is a hand hole at the top and an outlet at the bottom so that the tank can be easily cleaned.

The steel water tank is hung at the rear of the truck and has a capacity of 250 gallons. There are drains on the bottom, and a manhole at the top which is large enough to render it easy not only to wash out the tank, but to scrub it with a broom if necessary, or to get inside for painting. The water tank is ordinarily filled by a steam siphon to which is connected a 1½-inch hose. This is always carried with the machine on a convenient bracket. On the front of the water tank

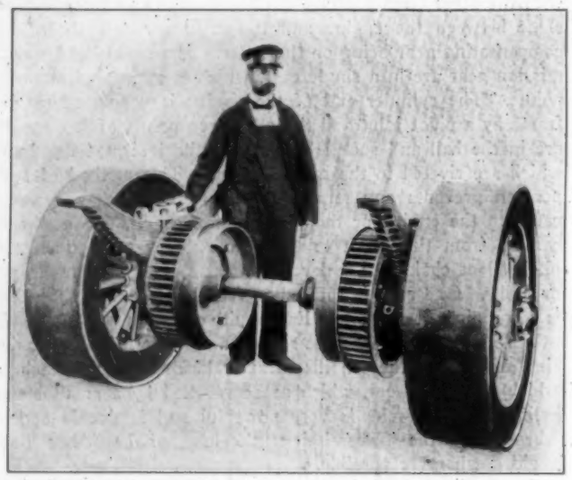


FIG. 4.—CONSTRUCTION OF REAR AXLE AND WHEELS.

is mounted a small, duplex steam pump which may be used to fill the boiler when the engine is standing still.

The driver's seat is on the left hand side of the boiler, there being a seat on the opposite side for a helper. In front of the driver is the water gauge glass, which is of the reflex type, and the valves which control the machine. The throttle is so made that when the lever is pulled back from the center, steam is admitted to the engine; but when the lever is thrown ahead of the center, the full boiler pressure is admitted to the brake cylinder before mentioned, and the machine is brought almost immediately to a full stop. If for any reason the brakes should fail to work, the engine is amply strong to withstand the strain of reversing under steam.

The valves for admitting steam to the low pressure cylinders and to the steam pump are close to the main throttle lever. Steam may be shut off from all parts of the machine by a main gate valve placed close to the boiler.

With the horse drawn vehicles the methods of mechanical loading are very few, and the loading mechanism is entirely outside of the vehicle, or is found in a hand winch at the front of the truck. When, however, the work of transportation is to be done by a machine, the problem becomes simpler. The two cranes and the capstans have already been mentioned. These will, of course, aid greatly in taking on heavy loads of almost any description where the places of stopping are many. It is possible, however, when regular runs are being made, with two or three regular stopping places, to reduce to a minimum the time that the vehicle must stand still. To accomplish this, a system of interchangeable bodies has been carefully worked up, for which a number of broad patents have been granted. In general the idea is as follows: If, for instance, one of the trucks is to run between two stations; from two to three bodies—and these are very strongly and cheaply built—would be supplied with each truck. At each station slips would be let into the platforms. When the truck backs into one of these slips, the body is left upon the platform in such a way that it is possible for the truck to run out from under. While this body is being loaded, the truck can back into a second slip, and there pick up a loaded body. This dropping and picking up of the bodies would occupy ordinarily but two minutes, as against anywhere from thirty minutes to an hour or more with the old system. These bodies are of a nominal cost as compared with the original cost of the truck, and by employing them it is possible to double the efficiency of the truck, and in that way cut in two the cost per ton of carrying material.

PERSONAL.

Charles Crowther, superintendent of the Niles, O., blast furnace plant of the National Steel Co., has resigned. J. C. Barrett has been appointed his successor with H. C. Streeter as chief clerk.

Milton E. Coombs, assistant general superintendent of the plants of the American Steel Hoop Co. in the Youngstown, O., district was handsomely remembered recently by the employes of these plants, who gave him a watch and chain and a chest of silverware. General Superintendent Jenks was presented with diamond cuff buttons.

Mr. and Mrs. H. C. Frick, of Pittsburg, were the guests of President and Mrs. Roosevelt at the White House last week.

F. Tanaka, directior of the Imperial railroad of Japan, and S. Awano, chief engineer of maintenance of way, spent several days in Pittsburg last week visiting the large railway supply manufacturers.

L. H. Constans, chief clerk of the freight department of the Baltimore & Ohio railroad at Pittsburg, has been appointed traffic manager of the Pittsburg Steel Co., of Pittsburg.

Andrew Carnegie's first dinner in his new house at Ninety-first St. and Fifth Ave., New York, was given on Thursday evening, Dec. 18, to his former partners in the steel business. Those present were W. E. Corey, H. P. Bope, L. T. Brown, Thomas Morrison, Thomas Lynch, George Lauder, Alexander R. Peacock, D. M. Clemson, George E. McCague, W. H. Singer, Homer J. Lindsay, W. C. McCausland, John McLeod, G. D. Packer, Charles L. Taylor, E. H. Utley, William M. Abbott, W. R. Balsinger, W. W. Blackburn, J. J. Campbell, A. C. Dinkey, A. R. Hunt, James Gayley, William R. Conrad, Joseph E. Schwab, W. C. Magee, O. W. Kennedy, D. G. Kerr and R. A. Frank.

J. J. Lumm, who has been purchasing agent for several years for the Advance Thresher Co, Battle Creek, Mich., will leave that company Jan. 1 to associate himself with the Battle Creek Iron Works Co. as general manager. He will be succeeded by O. J. Cessna, who has been with the Advance Thresher Co., for eight years. This company has issued a circular letter speaking in complimentary terms of both gentlemen.

The resignation of S. E. Treat as master mechanic of the Ohio plant of the National Steel Co., has been accepted, to take effect Jan. 1. He will take a Southern trip before again engaging in business.

The National Novelty Corporation, recently incorporated with a capital of $7,000,000, includes 41 manufactories, 24 of wood and 17 of iron, the products being toys and novelties. At a recent meeting 27 directors were elected, 15 from the wood and 12 from the iron industries. The following officers were elected: N. H. Colwell, president, Pawtucket, R. I.; a vice president was elected from each of the industries, W. R. Kidder, of Kalamazoo, Mich., from the wood, and A. C. Williams, of Ravenna, from the iron; treasurer, F. W. Crandall, of Elkland, Pa., from the wood industry; secretary, Chas. W. West, of Toledo, O., from the iron industry. The consolidation embraces over 95 percent of the business in this line in the United States.

LAKE ERIE ORE RECEIPTS 22,549,424 TONS.

Shipments of iron ore by water from the Lake Superior region in the season of 1902 amounted to 27,039,169 tons, an increase of 6,881,647 tons as compared with 1901. Reports just received from Lake Erie dock managers show that of the total shipments there were sent to Lake Erie ports 22,649,424 tons, an increase of 5,632,348 over 1901. We give below our annual tables showing shipments by ports, also the receipts at each Lake Erie port and the amount on dock at the close of navigation. As for the three preceding years, Two Harbors has the largest total of shipments. Duluth now holds second place, which last year was held by Escanaba and by Duluth in 1900. Superior and Ashland have made heavy gains, while Marquette has made a small advance, and Gladstone shows a falling off.

	1902.	1901.	1900.	1899.
Escanaba,	5,413,704	4,022,668	3,436,734	3,720,218
Marquette,	2,595,010	2,354,284	2,661,861	2,733,596
Ashland,	3,553,919	2,886,252	2,633,687	2,703,447
Two Harbors,	5,605,185	5,018,197	4,007,294	3,973,733
Gladstone,	92,375	117,089	418,854	381,457
Superior	4,180,568	2,321,077	1,522,899	878,942
Duluth,	5,598,408	3,437,955	3,888,986	3,509,965
Total by lake,	27,039,169	20,157,522	18,570,315	17,901,358
Total, all rail, ...		431,715	489,078	350,446
Total shipments, ...		20,589,237	19,059,393	18,251,840

To arrive at the total shipments from the Lake Superior mines, Michipisoten, the Canadian port on the north shore of Lake Superior, should be included. It shipped 298,420 tons, making the total of water shipments 27,337,589. Of the Michipicoten Bay shipments, which were all of ore from the Helen mine, 205,498 went to Lake Erie ports and the balance to Hamilton, Ont., and Midland, Ont.

The totals of our tables showing receipts at Lake Erie ports and stocks on dock are as follows:

Receipts at Lake Erie ports, 1902, 22,649,424 tons. On docks at Lake Erie ports, Dec. 1, 1902, 7,074, 254 tons.

Our statistics of last May showed 2,848,194 gross tons on Lake Erie docks at the opening of navigation this year. Adding to this the receipts of the season just closed and subtracting the amount on dock Dec. 1, we have 18,423,364 gross tons as the shipments to furnaces in the season of navigation, including ore unloaded directly upon furnace docks, as against 14,204,596 gross tons in the corresponding period of 1901 and 11,613,773 tons in 1900. The following table gives the receipts at Lake Erie ports in 1901 and the five years preceding:

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

Ports.	1902.	1901.	1900.	1899.	1898.	1897.
Toledo	1,017,571	798,298	645,147	792,348	414,012	416,438
Sandusky.....	165,556	33,017	154,542	87,499	136,200	79,792
Huron	520,646	431,311	321,914	263,600	126,755	198,231
Lorain	1,446,417	721,662	1,090,235	1,112,946	536,086	355,188
Cleveland.....	4,873,318	3,831,060	3,376,644	3,222,582	2,645,318	2,456,704
Fairport	1,538,744	1,181,776	1,085,584	1,241,013	912,879	1,008,340
Ashtabula	4,796,805	3,981,170	3,709,486	3,341,526	2,684,163	3,001,914
Conneaut	4,300,301	3,181,019	2,556,631	2,320,696	1,404,169	495,327
Erie.....	1,717,268	1,379,377	1,240,715	1,309,961	1,092,364	1,311,526
Buffalo ..... } Tonawanda.. }	2,256,798	1,475,386	1,616,919	1,530,016	1,075,975	797,446
Total..	22,649,424	7,014,076	15,797,787	15,222,187	11,028,321	10,120,906

Cleveland this year takes the lead of Ashtabula, which had the largest receipts in 1901 and 1900. Conneaut has again made a heavy advance. The following table shows the amount of ore on dock Dec. 1:

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

Ports.	1902.	1901.	1900.	1899.	1898.	1897.
Toledo.....	310,023	254,196	242,375	186,422	146,568	184,644
Sandusky.....	9,175	47,384	95,111	23,184	48,500	84,786
Huron	232,764	231,501	211,377	164,480	139,982	230,029
Lorain	328,304	195,863	261,838	337,822	324,934	317,509
Cleveland	1,500,604	1,378,060	1,337,415	1,200,806	1,175,970	1,478,355
Fairport.....	924,236	710,590	611,717	692,147	719,794	825,312
Ashtabula	1,967,136	1,769,145	1,811,459	1,902,598	1,732,671	1,835,694
Conneaut.....	673,679	604,106	630,514	468,808	388,101	360,895
Erie.....	721,966	470,788	480,731	361,333	439,167	484,871
Buffalo.. ..... } Tonawanda.. }	319,367	198,100	232,100	192,681	121,620	111,660
Total.....	7,074,254	5,859,663	5,904,670	5,530,283	5,136,407	5,923,755

Claire Furnace, at Sharpsville, Pa., is about to blow in after being out for 90 days.

FURTHER STEEL CORPORATION ACQUISITIONS.

The announcement of the taking over of the newly formed Union Steel Co. by the United States Steel Corporation has been widely discussed in the past week, particularly in the light of a change in the policy of the corporation respecting the acquisition of outside properties. The special immediate advantage in the Union company purchase is that the steel corporation gets needed blast furnace and open-hearth capacity and at the same time finds an outlet in the finishing ends of the Donora and Sharon plants for a surplus of Bessemer steel. Ultimate advantage, of course, lies in putting an end to competition that in the wire and nail trades might have proved uncomfortable.

The week has brought the announcement of the acquisition by the steel corporation of the property of the Troy Steel Co., at Breaker Island, opposite Troy, N. Y. This it will be recalled, was sold some months ago to W. F. Donovan, representing interests who incorporated the Troy Steel Products Co. and made plans for starting up the plant and adding some finishing capacity, tin plate and wire mills being considered. These plans are now given up. The advantage to the steel corporation in this purchase is that it provides blast furnace capacity to supply iron to the Worcester, Mass., open-hearth plant of the American Steel & Wire Co. There are three furnaces at Breaker Island, each 80x18 feet, and having a total annual capacity of 160,000 gross tons. They use magnetic ores from Essex and Columbia counties, New York. The mill machinery of the Bessemer plant on Breaker Island, and of the connected Renssalaer Iron Works at Troy (the latter including merchant mills for shapes, sheets and merchant steel of various descriptions) will probably be removed to some locality in the West where it can be used to better advantage.

As noted last week, the Union Steel Co. purchase revived reports of further buying of competing plants by the steel corporation. The reports concerning the Jones & Laughlin Steel Co. and the Cambria Steel Co. were authoritatively denied and it may be said that no negotiations are under way involving either company. More persistent reports, however, relate to the Clairton Steel Co., whose three modern blast furnaces and twelve 50-ton open-hearth furnaces are now under construction at Clairton, Pa. On the face of it the report does not seem probable, viewing the company in its relation to the Crucible Steel Co. of America, which controls it. But in addition to its blast furnaces and open-hearth plant the Clairton company has some excellent and extensive ore properties which the steel corporation might consider worth acquiring. It has also valuable coking coal properties. Our advices are that there is no truth in the report that the steel corporation has bought the Clairton property or the blast furnaces of the Shenango Furnace Co., owned by W. P. Snyder, the president of the Clairton concern. However, reports of intended acquisition and of negotiations continue, and the trade is prepared to hear further news in this line. That the corporation already has considerably more than half the Lake Superior ore reserves, possibly two-thirds, is well known; but its purchases of ore properties are not considered ended. The important Hill interests on the Mesabi range might prove attractive if a new campaign of mine buying is entered upon. The hauling of the ore by the Great Northern road was the object of the Hill acquisition in the beginning, and any sale of the ore lands would no doubt carry the condition that the Hill road should carry the ore. This would not necessarily be insuperable, even though the corporation owns the other two ore roads of Minnesota.

In connection with this renewed interest in the corporation's plans of acquisition, and the evidence that the policy of inaction respecting outside properties is now to give way to one of securing a larger grip upon the steel production of the country and upon Lake Superior mining properties, has come a discussion of changes in the corporation's officials. There is more than mere rumor in the statement that H. C. Frick is to become chairman of the executive committee of the corporation, succeeding Judge E. H. Gary. And in case Mr. Frick becomes so identified with the corporation he will no doubt be its directing head. What change in the presidency may come at the same time is not so certain. Various names have been mentioned in this connection.

MR. CLERGUE ON THE LAKE SUPERIOR CONSOLIDATED CO. SITUATION.

At Sault Ste. Marie, Ont., Mr. F. H. Clergue gave out a statement last week which seemed to dispel the apprehension felt for the industrial future of that city. He said that as a result of the negotiations in Philadelphia the sum of $8,000,000 was now at the company's disposal to meet present liabilities and to carry to completion within the next year or so the works now under way. This loan, he explained, was necessitated by the company having spent money in the completion of its industries more rapidly than it could be acquired in the ordinary process of calls on stock. He added that the loan was floated on the security of the uncalled stock, which amounts to $8,000,000, as well as the securities of the company. The steel mills, Mr. Clergue said, were assured of one or two orders besides that of the Temiskaming railroad—enough to keep the rail mill running for several months.

There has evidently been a good deal of discussion in Canadian railroad circles concerning the quality of the rails turned out at the Algoma Steel Co.'s mill at Sault Ste. Marie, Ont. On this matter Mr. Clergue goes into a long statement covering two columns in Toronto newspapers. One feature of it which will be news to the iron trade is the reference to ore property on the Mesabi range held by the Clergue interests. We quote the following:

"The Intercolonial Railway, the Michigan Central, the Canadian Northern, the T., H. & B. Railway and the Algoma Central all have our rails laid and in use, and the most of our customers, including the Canadian Northern, have asked us to tender for additional requirements. The only reason why the Canadian Northern did not give us their order for 40,000 tons, delivery for 1903, was the plain business reason that we wanted $32 for rails at Port Arthur, while they could buy equivalent rails at $27.50. The Algoma Steel Co. disclaim any ground to complain against Mackenzie, Mann & Co. They are enterprising people, and if they can rail the Canadian Northern with German rails of a satisfactory quality at a cost of $27.50 a ton against Algoma Steel at $32 per ton they were certainly justified in doing so, since this large direct saving is of much more consequence to them than to have a rail mill running in Canada. But the people of Canada who have subsidized the Canadian Northern Railway are very much interested in having established an industry employing from the mines to the finished rails several thousands of people, and the Algoma Steel Co. are satisfied that the Government will pay no subsidies to the Canadian Northern on track laid with German rails, sold by German manufacturers at a loss for the purpose of shutting down a Canadian rail mill.

"Some public comment has been made of the fact that the Algoma Steel Co. recommended a phosphorus content higher than the present recognized standard of .10. This position of the Algoma Steel Co. may require an explanation. It should at first be stated and understood that the Algoma Steel Co. can procure material for making rails of .10 phosphorus content more cheaply than a material of higher phosphorus content; so that the cheapest rail possible for the Algoma Steel Co. to make would be the ordinary rail of .10 phosphorus. This is due to the fact that the ores controlled by the Algoma Steel Co., namely, those of the Helen and Josephine mines, are of a physical quality so much better than the low phosphorus ores of the Mesabi range that it is more profitable to transport the Helen and Josephine ores to United States ports, pay the American duty, and sell to the American furnaces than to use these ores in rail making at the Sault. The low phosphorus Mesabi ores are so abundant, and the quartz of this ore, which can be used owing to its physical characteristics so relatively small, that non-Bessemer Helen ore is sold at Lake Erie ports of the United States from 50c to 75c a ton more than Mesabi ores of an equal iron content. So that the Algoma Steel Co. can exchange Mesabi ores for its Helen ore at a substantial profit.

"For this very reason the Algoma Steel Co. has acquired ownership of Bessemer iron ore deposits on the Mesabi range, sufficient in quartz to operate its plant for the next ten years, without using a ton of ore from the Michipicoten range. It should thus be distinctly understood that there is no financial benefit whatever in the production by the Algoma Steel Co. of higher phosphorus rails."

In the further course of his statement Mr. Clergue says that the steel company will make a five-year guarantee on its rails, but it must be allowed in that case to determine the chemical constituents of the steel. The Dominion Government's specifications are on this basis. The call for the five-year guarantee but leave the composition of the steel to the maker's judgment. The Algoma Steel Co. has conducted tests covering six months, with the ores it finds best available and these conclusions have been reached: "The best proportion of phosphorus and carbon to procure the hardest possible wearing surface and at the same time a strength sufficient to resist the blows of modern heavy locomotives, is phosphorus, .13; carbon, .35, and this is the standard composition which the Algoma Steel Co. offer in guaranteeing five years' wear for a 60-pound rail. And this 60-pound rail Mackenzie & Mann may lay on the Canadian Northern with safety for heavy traffic. The Algoma Steel Co. accompanies this guarantee, of course, with the provision that the rails shall be subjected to exactly the same physical tests as are required in any of the standard specifications, and any rails not enduring the test are of course rejected. For street railroad use where the much more frequent hammering of wheels over the joints occur, but where the load on the rail is much lighter, the Algoma Steel Co. recommend .16 phosphorus and .30 carbon. With this chemical composition, the Steel Co. will guarantee any of its rails for five years."

"The composition having been determined, the manipulation of the rail, in the process of manufacture, was made the special feature of the Sault Ste. Marie mill, and where in a a modern fast rail mill an ingot is subjected to 18 to 20 passes through the rolls, or what may be regarded as an 18 to 20 distinct forgings, every rail passing through the Sault Ste. Marie mill is subjected to thirty passes through the mill or thirty forgings. Everybody knows the beneficial effect of forging on the toughness of steel or iron, and the most instructive evidence of this is furnished at the Sault Ste. Marie works, where for experimental purposes rails have been rolled with phosphorus as high as .34, which uniformity endured all of the physical tests required by any specifications stipulating .10 phosphorus. Sixty-pound rails manufactured by the Algoma Steel Co. carrying .16 phosphorus can be seen at the works twisted cold in the shape of corkscrews without the slightest evidence of fracture. Indeed, most of the old-fashioned rails which railroad engineers claim they cannot now have duplicated, were high in phosphorus. When R. W. Hunt, now head of the Hunt Inspection Bureau, was superintendent of the Johnstown rail mill, the rails rolled under his direction contained .16 phosphorus, and users claim they are much better than any rails at the present day. These Johnstown rails with high phosphorus were well and carefully rolled; this composition might produce an extremely brittle rail if too quickly rolled."

Jones & Laughlin Steel Co. Extensions.

At a meeting of the executive committee of the Jones & Laughlin Steel Co., of Pittsburg, held several days ago, the question of erecting one and possibly two additional furnaces was discussed and while no definite steps were taken it was practically decided to make the increase in pig iron producing capacity. Owing to the present crowded condition of the shops of the blowing engine builders it is almost impossible to obtain deliveries in less than a year. If it is found, however, that earlier deliveries can be had a contract for the erection of at least one furnace will be awarded shortly. For the past six months this concern has been compelled to purchase Bessemer iron in the open market owing to the increase of its Bessemer steel capacity by the addition of one converter. The Talbot furnace also consumes several hundred tons of pig iron daily and it is for the purpose of providing iron for this increased steel making capacity that the additional stacks are to be erected.

The second annual dinner of the heads of departments of the Pressed Steel Car Co. was held at the Hotel Schenley, Pittsburg, on Saturday evening, Dec. 20. At each plate was an envelope containing an extra month's salary for each of the employes. Directors of the company not holding official positions were the guests of honor.

TRADE PUBLICATIONS.

"A Treatise on Sharpening and Grinding Milling Cutters, Reamers and Other Tools" is the title of a 6x9 pamphlet published by the Cincinnati Milling Machine Co., of Cincinnati. The publication extends to 64 pages and has special reference to the universal cutter and tool grinder made by this company. The firm is a well known manufacturer of milling machines also and the use of properly sharpened tools greatly increases the efficiency of this type of machines as well as others and in this way both milling machine and grinder are benefited by practical suggestions for cutter grinding betterment. The treatise is therefore issued with a view of suggesting through the elaborately finished illustrations not only the variety of work capable of successful and profitable grinding but to assist the operator in the correct manipulation of the machine. We understand that the pamphlet is for gratutious distribution.

The "Model" gas and gasoline engines are described in catalogue No. 11 of the Central City Iron Works, R. A. Cook, proprietor, Stevens Point, Wis. These engines are guaranteed to run on gasoline, distillate, kerosene, high grade crude oil, coal or producers gas, and are made in some 16 sizes having a rating of 2 to 100 horsepower for stationary purposes. A similar list of sizes but of greater weights and higher speeds are quoted for engines for electric lighting and there are a number of pumping and portable power equipments of various kinds illustrated and described.

The International Gas & Fuel Co., of Chicago, has a catalogue descriptive of oil fuel apparatus. The system discussed is based on the injector oil burners introduced by Williams, Wright and Armstrong. In addition to the testimonials frequently found in publications of this kind there is an interesting report of a test conducted by Prof. Denton of the Stevens Institute of Technology, Hoboken, N. J. The test was undertaken to ascertain the fuel value of crude petroleum from the Export Oil & Pipe Co., of Beaumont, Tex., and is on that account of additional interest over and above the matter of a particular make of burner, etc. The professor describes some experiments undertaken at the same time to find the inflammatory quality of the oil. The experiments showing that the oil does not have a volatility to give rise to inflammable vapor until it is heated above 142 degrees F. at which point the vapor is essentially identical with that given by gasoline at ordinary temperatures.

The catalogue of saddlery and saddlery hardware handled by the Simmons Hardware Co., of St. Louis, is a portly volume of some 460 pages, 7x9½ inches. The book is evidently an expensive effort and the company has been prodigal of labor in the production of fine engravings, an excellent index, special borders, attractively printed cloth covers and the other accompaniments of the best in industrial book work. Altogether Catalogue No. 433 is a commendable effort and the authors can deservedly be proud of the production.

Wyman & Gordon, of Worcester, Mass, manufacturers of machine forgings, have sent out another of these readable circulars which show the range of the firm's product and take the place of a catalogue. The present short story by Mr. Goddard is a worthy addition to the eight predecessors and tells the tale of John Ericsson. This able pioneer is eminently deserving of a place with the series ranging from Watt to Krupp and his characteristic traits are treated in good taste though of course with very limited scope.

The F. D. Cummer & Son Co., of Cleveland, describes in a recent pamphlet the "Cummer" dryers as applied to the heating and ventilating of workshops, public buildings as well as the treatment of moisture in ores, etc. The dryers are made either in stationary and portable forms, revolving and tunnel, direct or indirect heat. The catalogue is 6x9 inches and extends to a hundred freely illustrated pages.

Several bulletins have been issued relative to the products of the machinery department of the Havana Bridge Works of Montour Falls, N. Y. These comprise pneumatic motor hoists, riveters, air compressors, hammers, cranes, etc. The hammers are made in six sizes and the riveters with bottom beading attachment will reach from 24 to 42 inches. The hoists are made in chain or wire rope pattern and with capacities up to ten tons, this rating being based upon an air pressure of 80 pounds per square inch.

The Fort Wayne Electric Works, of Fort Wayne, Ind., has a new set of bulletins descriptive of the B and B commutator truing device which can be readily adapted to all sizes and makes of machines without the removal of the armature; another is devoted to mast arms, outriggers, pulleys, etc. Primary fuse boxes and transformers are treated in two small circulars.

CENTRAL AND EASTERN PENNSYLVANIA.

HARRISBURG, PA., Dec. 23.—Once more the scarcity of fuel is causing trouble for the mills and furnaces of Eastern Pennsylvania and there are a number of works which have not been able to keep going regularly within the last two or three weeks. In this city several plants among them the Pennsylvania Steel Co.'s works, have been more or less handicapped by the inability of the railroads to keep the supply up to the mark and this, too, with the latter using cars owned by the steel companies. The whole Lower Susquehanna valley is affected. Better times are promised after the new year if the weather does not interfere, as the railroads will have a number of improvements on lines and in yards in operation before long.

The Temple Iron Co., of Reading, of which George F. Baer is president, has increased its bonded debt by $500,000 so that it is now $3,326,000. The increase is for coal lands and coal mining machinery as by the company's charter, granted 40 years ago, it can engage in coal mining as well as iron manufacturing. It operates a furnace at Temple and has a sinking fund of 15 cents on every ton of coal mined. The great coal roads have guaranteed its bonds for years.

Good times are predicted for the new year at York. Every works has many orders on the books and the outlook for continued operation of the iron works is excellent.

The Sheridan furnaces are being overhauled preparatory to starting next year. There are two stacks at Sheridan near Lebanon.

The Reading Iron Co. has dismantled its old forge in Reading after over half a century of operation.

The Thomas Iron Co. is preparing to start more of its furnaces. The stacks have been running irregularly since the coal strike.

The Pennsylvania Railroad is preparing extensive plans for additions to its Altoona shops. The foundry capacities will be increased.

The Chesapeake Nail Works in this city have been idle for two weeks because of the scarcity of coal, the deliveries from the western part of the State being considerably smaller than required for this city.

The Lehigh Foundry Co. has increased its capital stock to $150,000 from $100,000. The plant at Allentown will be increased. The Wilkes Barre & Scranton Coal & Iron Co. has increased its stock to $275,000.

A part of the new plant of the Diamond Drill & Machine Co., at Birdsboro, will be started in the new year.

The Hayward Foundry & Machine Co., of Monongahela City, has been incorporated here. The company has $25,000 capital and its directors are J. B., George, S. L., Harry and J. B. Hayward, Jr.

The Geiser Mfg. Co., of Waynesboro, has received an order for a large engine to be shipped to Durban, South Africa. It will run six plows with a 14-inch cut.

The Leesport Furnace will be started up within the next week. It is being relined and repaired.

The Bethlehem Steel Co. has dismantled its old Bessemer mill at Bethlehem and in place of the converters there has been erected a modern foundry. The company will make over 30,000 tons of cast iron segments for the Hudson River tunnel at this new department. The company has also taken several hundreds of thousands of dollars worth of government gun work and has many rail orders booked for the new year.

The Lalance & Grosjean tin plate mills in Harrisburg are now run by electricity except for the rolls for which the large engine is still used. Further improvements are contemplated.

Joseph Wharton, owner of the Port Oram furnaces in New Jersey, is building a coke oven plant in Cambria County. Several other plants are contemplated, as the irregularity of the coke supply and the curtailment of shipments to small iron producers has caused some uneasiness. Two plants are planned for Lebanon, one being partly under way at this time.

A. B. H. JR.

MERRILL-BRETT DROP HAMMER.

E. W. Merrill, Jr., of Brooklyn, N. Y., is introducing in this country the Brett patent steam and compressed air, semi-rotary drop hammer lifters. These lifters can be operated in two ways; either by delivering one, or a series of equal blows automatically, or by giving variable light and heavy blows—blows of the elastic nature best suited for stamping or forging, as the return of the hammer is instantaneous.

The hammer can be made to operate as fast as is consistent with the successful manipulation of the stock in the dies, and the rate of 50 to 70 strokes per minute can ordinarily be obtained, while at a very low fall 100 blows per minute can be given. When necessary, lifters can be made to operate hammers weighing several tons, and these may be as easily worked as the smaller sizes.

The steam having a clear passage to the exhaust, the hammer has a perfectly free fall. The only connection necessary to the drop hammer is a pipe to convey the steam or compressed air, and this can be placed in any convenient location of the factory, regardless of the line shafting.

Compressed air for this purpose is of increasing importance and whenever, by reason of the general use of electric drive, or of water power, live steam is not available for the drop hammer, compressed air can be used in the same manner as steam, and without changing any parts of the machine. No power is lost, while operating, in changing direction of motion, as the piston shaft has but a partial rotation in its bearings, when returning to the starting point.

The illustration in Fig. 1 shows a self contained automatic drop hammer. The two levers fastened to the right hand side of the drop hammer are respectively connected to a light rod, which controls the throttle, and automatic trip valves.

One of the levers moves between two quadrants containing a series of notches which hold the lever in any desired position. If the lever is placed in the highest, lowest or any intermediate notch, the hammer will trip automatically at a corresponding high, low or intermediate fall. This change of distance can be made in a few seconds, while the hammer is in operation or at rest.

The drop is worked automatically by releasing the latch with the aid of the treadle, the same as on a board lift drop, a repeated number of blows being given until the foot is removed. The variable light and heavy blows are are obtained by operating the throttle lever, as on a steam hammer. There are no rods or slides for the hammer to strike, as the tripping is accomplished by the semi-rotary shaft and without jar.

Almost any kind of an overhead support or platform will answer, as there is no tendency of the platform to rack or sway sidewise, owing to the easy and uniform movement of the parts; the only strain upon the supports is the downward pressure equal to the lifting force. The lifters can also be placed upon the floor above the drop hammer, on the floor behind the base or at right angles to the sides and above the hammer. Figs. 2, 3 and 4 show the principal parts of the lifter.

The shaft, levers (or lifting arms) and piston, as shown, are fastened together to form practically one solid piece. This is the only working part and is free to rotate about three-quarters of a revolution in the cylinder. The cylinder is shown with one end cover removed, and it will be seen there is a division piece which is securely bolted to the side. The bearings in which the shaft turns are long, to give ample wearing surface and are made steam tight by ordinary stuffing boxes. The packing strips are placed in grooves in three sides of the piston blade and in the division piece, and are pressed outward by springs to keep the piston steam tight.

The pulley is strongly built of wrought steel, and turns

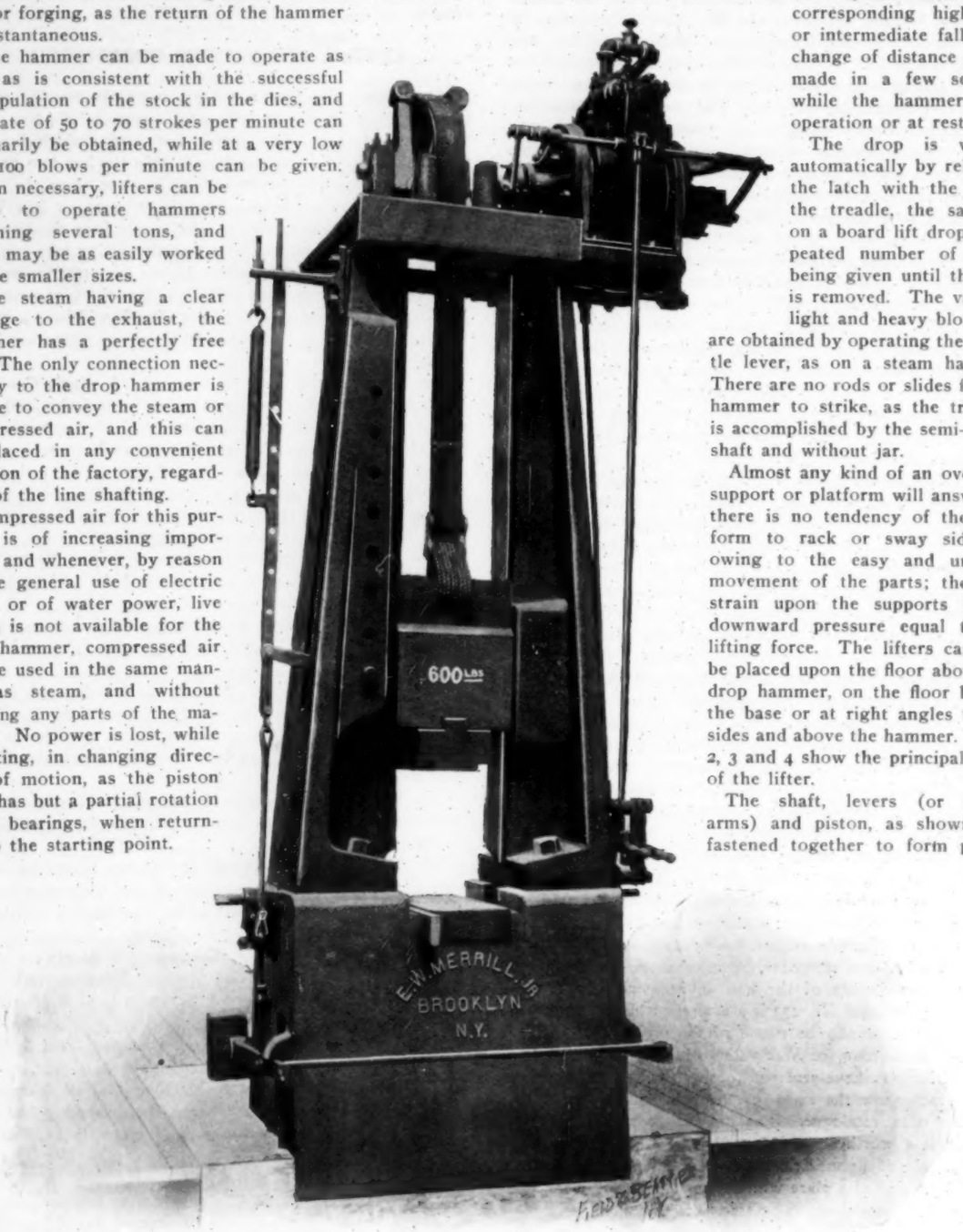


FIG. 1.—AUTOMATIC STEAM OR COMPRESSED AIR DROP HAMMER.

The important items in the economy of power by this system are in avoiding the necessity of driving heavy line shafting and slipping belts, and in not expending power while the hammers are not actually at work. The cost of heavy engines, shafting, hangers, and long belts necessary for the usual method of drop hammer drive is avoided and the initial cost of a plant is materially reduced.

These lifters are successfully used in connection with stamping hammers having a very large striking surface; as any unevenness of striking, or looseness in the guides does not in any way affect the lifter or its connections.

freely on the shaft between the two lifting arms. The pulley is thus free from all strains of lifting and merely serves as an idler.

Fig. 5 shows a sectional view of the cylinder with the piston, lifting arms and idler pulley in their respective positions. With the parts as here shown, the hammer would be down and at rest. In order to raise hammer, the steam enters the port A, presses against the piston wing B, and forces the piston to a position, say, at E. When the piston reaches the position E the live steam is cut off and the steam in the cylinder returns through the port A and out to the exhaust; at the same time the piston E returns to the starting point B, this operation being repeated any number of times desired. The lifting arm F being a part of the piston shaft C, consequently when the piston B takes the position at E, the lifting arm F will take the position K. The lifting strap H is fastened to the two arms by the cross-bar G, consequently when F takes the position K, the hammer, which is fastened to the strap, will be lifted a certain distance, this distance being varied by the position of the operating levers. D is the division block and L the relief and safety vent. It will be noticed that the loose pulley J is not fastened to the shaft, and therefore serves merely as an idler to change the rotary movement of the strap to a vertical and central lift, consequently giving a perfectly uniform movement to the hammer. Lifters can be made to raise hammers to any height desired, by increasing length of lifting arms and diameter of pulley.

The great scope of these hammers in the field of die forgings is illustrated by a soft steel locomotive piston weighing 240 pounds, drop forged by one of these large hammers.

Eighteen of these hammers are installed in the forge shop of the locomotive works of the London & Northwestern R. R. at Crewe, Eng.

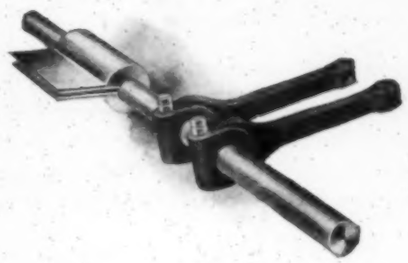


FIG. 2.

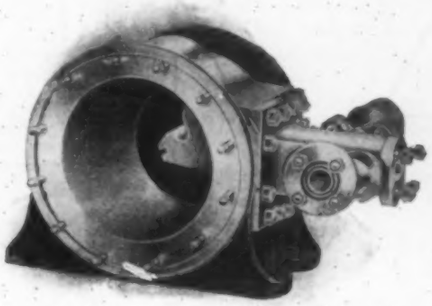


FIG. 3.

FIG. 4.

PRINCIPAL PARTS OF LIFTER.

OBITUARY.

Matthew C. Reddin, proprietor of the Reddin Iron Works and founder of the Economy Foundry at Syracuse, N. Y., died at the latter place Dec. 17, aged 52 years. About 15 years ago he was one of the organizers of the Economy Foundry and 5 years ago he established the Reddin Iron Works.

Edward Little, auditor and assistant treasurer of the Westinghouse Airbrake Co., died at Pittsburg on Tuesday, Dec. 16, aged 50 years. He was unmarried.

George W. Prescott, one of the principal stockholders of the Union Iron Works, San Francisco, and for several years president of the company, died on Saturday, Dec. 13, at the Palace Hotel, San Francisco, Cal., from heart failure. Mr. Prescott was ranked by his business associates as a financier and mechanical engineer of the highest order. He went to the Pacific Coast in the early fifties and engaged in the machinery business in Marysville, Cal. Though then a mere boy he won recognition from the start. In 1863 he became a partner of his Marysville employer and together they bought out the Donahue Iron Works of San Francisco. In 1875 the firm was changed to Prescott, Scott & Co., which incorporated in 1883 as the Union Iron Works. Mr. Prescott was the first president of that concern, resigning the office in 1890. He retained his prominence in the councils of the company up to the time of his death. The deceased was 69 years of age. He was born in Maine, going from his native State to Boston to learn the machinist's trade.

Charles Thompson Neale, one of the pioneer iron manufacturers of the Pittsburg district, and president of the Kittanning Iron & Steel Co of Kittanning, Pa., died at his home in Pittsburg, Dec. 20, aged 70 years. Mr. Neale was born in Kittanning. When 16 wears old he went to work at the Clarion furnaces in Clarion county, Pa. He remained there until 1858, when he went to Pittsburg. He found employment with the old hardware house of Whitmore, Wolff, Duff & Co., which is still doing business on Wood St., Pittsburg, under the name of Wolff, Lane & Co. In a short time he became a member of the firm. He continued with the firm until 1879, when, with James I. Bennett, James Brown and others he organized the Kittanning Iron & Steel Mfg. Co. He became the firm's first president and continued at its head up to the time of his death. The firm is still in business at Kittanning. Mr. Neale is survived by his wife and four children. The latter are Charles T. Neale, Jr., of Buffalo, N. Y.; James and F. C. Neale, and Mrs. George Heard, all of Pittsburg.

The Champion Rivet Co., of Cleveland, has favored us with a large calendar bearing an allegorical figure illustrative of the flight of time. We also acknowledge the receipt from the Bourne-Fuller Co. Cleveland, of a calendar with an excellent reproduction in color of Laura Miller's "Village Blacksmtih." The copy embodies the spirit of the original picture and the vigorous figure of the workman, illumined by the glowing metal and forge, stands out in strong relief against the dusky background of the smithy.

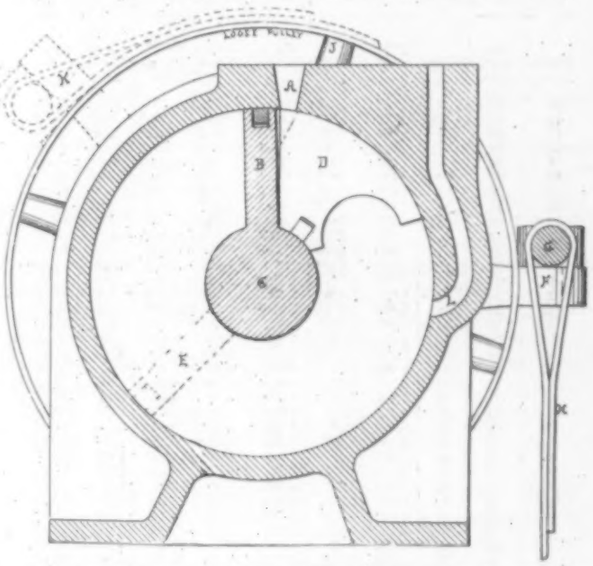


FIG. 5.—SECTIONAL VIEW OF CYLINDER, LIFTING ARMS, ETC.

The Pittsburg Steel Foundry Co., of Pittsburg, Pa., has just completed a large gear rim casting at its plant at Glassport, Pa., for the Bass Foundry & Machine Co., of Fort Wayne, Ind. The rim is 17 feet in diameter and weighs 45,000 pounds.

FINER SCREW THREADS.*

BY CHARLES T. PORTER, MONTCLAIR, N. J.

I have for several years felt a growing conviction that the pitches of our machine screw threads are far too coarse, and ought to be changed. They reduce the area of the bolt unnecessarily. The Sellers thread made a considerable gain in this respect, but in the larger bolts the reduction of area is still two or three times as much as it needs to be. Again, the inclination of the thread permits the nut to be jarred loose easily. For these two reasons, threads of much finer

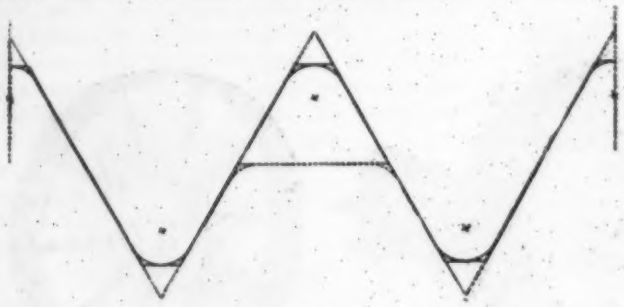


FIG. 1

pitch seem to be called for. Finer threads will also be stronger to resist stripping, the circle on which the shear must take place being larger. This, however, is of no practical consequence, as the strength of threads to resist stripping in nuts of standard height is now more than twice the strength of the bolt.

The gain in strength of the bolt by the use of finer threads is shown in detail in the following table, and the reduction of the inclination is illustrated in the diagrams. The system there represented is one that I have contemplated for my own use. Other engineers may think it will be useful for them also. It will be observed that fractions and odd numbers are avoided, and that the coarsest thread is six to the inch. Sharp angles at the bottom of threads—even the ob-

Number of Threads to the Inch.		Diameters.			Areas.			Increase of Area.	
		Of Bolt.	At Bottom of Thread.		Of Bolt.	At Bottom of Thread.			
Present.	Proposed.	Inches.	Present. Inches.	Proposed. Inches.	Square Inches.	Present. Sq. Ins.	Proposed. Sq. Ins.	Square Inches.	Per cent.
20	24	¼	.185	.1958	.04908	.027	.03	.003	11.11
18	24	5/16	.240	.2383	.07669	.045	.0525	.0075	16.66
16	22	⅜	.294	.3160	.1104	.068	.0783	.0105	15.44
14	22	7/16	.344	.3735	.1503	.093	.1125	.0195	20.96
13	20	½	.400	.435	.1963	.126	.1488	.0228	18.09
12	20	9/16	.454	.4975	.2485	.162	.1943	.0323	20.
11	18	⅝	.507	.5525	.3067	.202	.240	.038	18.81
10	18	¾	.620	.6775	.4417	.302	.361	.059	19.53
9	16	⅞	.731	.794	.6013	.420	.495	.075	18.
8	16	1	.837	.919	.7854	.550	.663	.113	20.54
7	14	1¼	.940	1.0315	.9940	.695	.837	.142	20.43
7	14	1¼	1.065	1.1565	1.227	.895	1.051	.156	17.43
6	14	1¼	1.160	1.2815	1.484	1.06	1.289	.229	21.6
6	14	1½	1.284	1.4065	1.767	1.297	1.555	.258	19.89
5½	12	1⅝	1.389	1.5165	2.073	1.518	1.808	.290	19.1
5	12	1¾	1.490	1.6415	2.405	1.743	2.115	.372	21.34
5	12	1⅞	1.615	1.7665	2.761	2.05	2.45	.400	19.51
4½	12	2	1.712	1.8915	3.141	2.305	2.81	.505	21.9
4½	10	2¼	1.962	2.12	3.976	3.025	3.53	.50	16.69
4	10	2¼	2.175	2.37	4.908	3.720	4.41	.69	18.54
4	10	2½	2.425	2.62	5.939	4.62	5.38	.76	16.45
3½	10	3	2.628	2.87	7.068	5.43	6.47	1.04	19.15
3½	10	3¼	2.878	3.12	8.295	6.52	7.65	1.13	17.33
3½	8	3¼	3.100	3.337	9.621	7.55	8.75	1.20	15.89
3	8	3½	3.317	3.587	11.044	8.65	10.10	1.45	16.76
3	8	4	3.566	3.837	12.566	10.00	11.58	1.58	15.8
2½	8	4¼	3.798	4.087	14.186	11.33	13.13	1.80	15.88
2½	8	4½	4.027	4.337	15.904	12.75	14.80	2.05	16.07
2½	6	4½	4.255	4.584	17.720	14.20	16.15	1.95	13.73
2½	6	5	4.480	4.784	19.635	15.78	18.00	2.22	14.06
2½	6	5½	4.730	5.034	21.647	17.52	19.90	2.38	13.58
2½	6	5½	4.958	5.284	23.758	19.28	21.90	2.62	13.58
2½	6	5½	5.208	5.534	25.967	21.25	24.05	2.80	13.13
2½	6	6	5.423	5.784	28.274	23.10	26.8	3.20	13.85

FIG. 2.

tuse angles of 120 degrees in the Sellers thread—invite fracture, especially in steel. A very small arc, preserving continuity of surface, will remedy this defect. In this system the angles will be rounded and fitted to the radius of .0045 inch.

The accompanying outline (Fig. 1) represents the finest thread, twenty-four to the inch, magnified. This arc, of .0045 inch radius, it will be seen, rounds this thread completely. The bottom of the coarsest thread, six to the inch, is also represented, on the same scale, in a dotted line. It shows the efficiency of this arc to avoid the breaking angle in all threads. This last feature I shall apply also to pipe threads.

It will be observed that in the bolts most commonly used the increase of strength averages about 20 percent, and that in the bolts above 2½ inches the strength of each bolt,

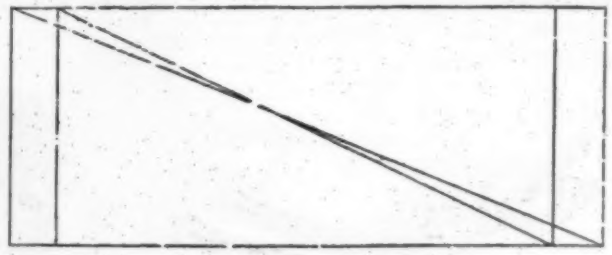


FIG. 3.

threaded on the system here proposed, will equal or exceed the strength of the next larger bolt, threaded on the existing system.

The reduction of inclination effected by the proposed system will be best shown by the graphical method. For this purpose I have selected the 1-inch bolt. If a right-angled triangle be drawn, the base of which is equal to the circumference of the top or of the bottom of the thread, and the height equals the pitch, the hypothenuse will represent the inclination of the thread and its length in one revolution.

But these angles are too small for distinct illustration. I have, therefore, drawn the following diagrams to two scales. The horizontal scale is full size. The vertical scale is ten times full size. In these the relation of the inclinations to each other can be accurately observed. It will be seen that while the reduction of the inclination at the top of the

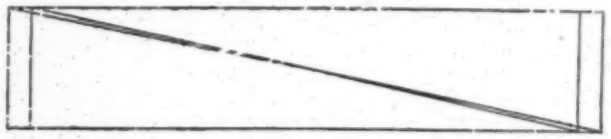


FIG. 4.

thread in this bolt is 50 percent, its reduction at the bottom of the thread is considerably more than 50 percent. An one who is so inclined can compute these inclinations in each of the 34 bolts. The above illustration seems sufficient for the purpose of my argument.

A recent booklet of Geo. G. Blackwell, Sons & Co., Ltd., of Liverpool, Eng., under the title "Points for Steel and Iron Makers," exploits its S. A. M. alloy for the use of steel makers and iron founders. The argument is that in order to prevent blow holes and produce sound ingots and castings it is necessary to add to the steel or iron an alloy consisting of several metals such as aluminum and manganese, having a greater chemical affinity for oxygen than the metals to be cast, and one or more electro-negative non-metallic elements, such as silicon or boron. The constituents of this alloy are converted by taking up the oxygen from the casting into single, double or multiple silicates, borates, etc., which produce a readily fusible slag. This slag forms quickly and rises in the form of globules through the liquid and much heavier material of the casting, rendering the latter free from blow holes. In steel practice with the open-hearth furnace the alloy, broken up, is added to the stream of molten metal as it is being tapped from the furnace into the ladle. In making crucible steel the alloy is broken into small pieces and stirred into the pot just before teeming.

The plows and plow fittings of the Oliver Chilled Plow Works, of South Bend, Ind., are enumerated in the revised trade catalogue "D." The extent of this particular industry is indicated by the dimensions of the plant at South Bend which is located on a 62-acre site and has 27 acres under roof. The catalogue has 144 pages.

* Read at the New York meeting (December, 1902) of the Society of Mechanical Engineers.

PRESIDENT PARRY ON LABOR UNION REDUCTIONS.

D. M. Parry, president of the National Association of Manufacturers, has issued a statement in which he says:

"The National Association of Manufacturers is opposed to any law which means the undermining of the commercial stability or the industrial vitality of the United States. It is opposed to the terrible anti-injunction bill now pending in congress, which proposed law has been imported to this country from labor-cursed England. This law has almost destroyed the English manufacturer, as it is a legalization of the picket and the boycott. The attempt to foist such anarchistic legislation upon the employers of this country will be resisted to the last.

"The National Association of Manufacturers is also unalterably opposed to the so called eight-hour bill fathered by Samuel Gompers. This bill, if it could be put into effect, would be a radical and destructive assault upon the prosperity of this country. While in the nature of things it would be impossible to put such an absurd law into practical operation, yet it would have the effect of dislocating business conditions, causing an industrial paralysis in this country the like of which we have never experienced.

"Such a bill would open the way of the blackmail of the heavy iron, steel and shipbuilding interests which are engaged in the manufacture of government supplies. They cannot run on an eight-hour basis from the physical nature of their work. By the terms of this proposed eight-hour bill an employer is penalized $5 a day for each and every man who is permitted to work over eight hours.

"The average worker does not want the law. The bill is an agitator's bill. These fellows are always willing to engage in any brawling or denunciatory assault upon employers. The average labor agitator is an Ishmaelite. His hand is raised against every man. The agitators have secured the passage of resolutions in which organized labor has set itself against the laws of the land, declaring that the laws which must be obeyed by others shall not be applied to them or they will rebel. Recently organized labor has made a concerted attack upon the national guard, driving non-union workmen from the militia. What for? Simply because under their present leadership the unions desire the overthrow of the law and the courts. They know that they cannot bring this about with the militia at hand to uphold the law. The agitators desire to build up a despotism inside the liberties of the United States. The employers of this country, however, do not propose that such an anarchistic element shall ever have charge of the destinies of the United States."

The International Trust Co., Baltimore, the largest single interest, has approved the proposed financial plan of the Alabama Consolidated Coal & Iron Co. It is now thought that the approval of the required 75 percent of stockholders is assured. This plan calls for an issue of $3,500,000 of 5 percent bonds, and an increase in the common stock of the company from $2,500,000 to $3,500,000. Of the bond issue there would be used $2,500,000 in exchange for a like amount of 7 percent preferred stock. Holders of this stock are to be a bonus of 25 percent in common stock to make this exchange. The holders of $500,000 of bonds now outstanding will have an opportunity to exchange for the new bonds.

A. V. Kaiser & Co., of Philadelphia, have purchased the entire plant, etc., of the Cuban Steel Ore Co., of Cherlorco, Cuba, which includes 73 miles of telegraph wire, rails, three locomotives, 100 cars, steel viaducts, bridges and piers, scows, hoisting engines, cableways, 26,000 feet of 3-inch water pipe, etc.

President McMahon of the International Association of Blast Furnace Workers and Smelters, announces that the headquarters of the association will be moved from Youngstown to Pittsburg. The executive board will soon meet in Buffalo to consider the question of asking for a reduction of hours of blast furnace workmen from 12 to 8 hours.

POLICY OF THE CONSOLIDATED LAKE SUPERIOR CO.

Theo. C. Search, vice president and treasurer of the Consolidated Lake Superior Co., has made an extended statement concerning the affairs of the company. He says in part:

"The only necessity for the borrowing of any money by the Consolidated Lake Superior Co. arose from the completion of construction contracts in advance of the payment due the company on account of subscriptions to the preferred stock. In anticipation of these payments a loan of $3,000,000 has been negotiated and the arrangements were practically complete when somebody started a selling movement and the market prices of the company's stocks went down so low that bankers who had virtually agreed to make the loan with the unmatured subscriptions for preferred stock and the accompanying common stock as collateral were unwilling to accept this security because of its reduced value, and the loan fell through. It became necessary, therefore, to reopen negotiations, and the arrangement of such a loan under existing conditions in the money market was not a matter that could be settled off-hand.

"All concerned in the conduct of the company's affairs are agreed as to the policy that should govern its operation, and no further expansion of its undertakings is contemplated. Ever effort will be devoted to the completion of works now under construction and the placing of all the company's operations upon a paying basis."

What the size of the loan will be Mr. Search was not able to say, but he believed the contracts for completing the company's railroad, and finishing the steel mills, with unpaid bills, would total up to date, $3,500,000. All of this, or whatever is loaned, will not have to be advanced immediately. By February the company should receive large sums from stockholders on account of their preferred stock subscriptions. One payment was due Dec. 15 and not later than 30 days thereafter, and another is called for not later than 30 days after Jan. 5, and as the issuance of $10,000,000 shares of commno stock as bonus hang on these payments, little defaulting is expected. Nearly $500,000 is owed to the Consolidated company by the Canadian Government, it appears, $424,000 being a railroad subsidy and $45,000 the price of steel rails sold to the government. But these payments have been delayed as the result of King Edward's coronation.

Increased Capital La Bel'e Iron Works.

At a meeting of the stockholders of the LaBelle Iron Works, of Steubenville, O., held at Wheeling, W. Va., it was decided to increase the capitalization from $5,000,000 to $7,500,000. Of the increased stock authorized only $500,000 will be issued immediately which will pay for the recent purchase of 500 acres of coal land and the erection of 200 coke ovens. The additional stock is to be kept in reserve and will be issued when aditional improvements are decided upon. During the year the company erected and placed in operation six open-hearth furnaces with a daily capacity of 600 tons and four more furnaces have been projected. Several pipe mills were also installed. The company's furnace at Steubenville, O., which was completely rebuilt during the year will be blown in within a month with a daily capacity of 400 tons.

At a meeting of American Locomotive Co. directors the following officers were relected: S. R. Callaway, president; A. J. T. Pitkin, vice president; R. J. Cross, second vice president; Leigh Best, secretary; C. B. Denny, treasurer, and C. E. Patterson, comptroller. The earnings of the company for six months ended Dec. 31, 1902, partly estimated, are stated to be $15,265,352, increase, $3,034,387. The company now has on its books orders for over 2,800 locomotives and is increasing its shop capacity and purchasing new tools as rapidly as it is possible to have them built and delivered.

The United States Cast Iron Pipe & Foundry Co. has just finished the delivery of eighteen miles of four-foot water mains for the Borough of Brooklyn. The contract price was about $700,000. The company has recently delivered the pipe on another contract in Philadelphia which was nearly as large.

THE DAKE MOTORS AND HOISTS.

The Dake Engine Co., of Grand Haven, Mich., is adapting its double reciprocating square piston motor to several purposes to which the dimensions of the compact machine make it well suited. For application of compressed air to this type of motor is an obvious development of the greater field of this motive power and the further service of the engine under these conditions lead naturally to cranes and similar machinery.

The Dake pneumatic chain hoist is illustrated in Fig. 1 and consists of a Dake reversing motor directly connected to a standard chain block. Two pendant hand chains control the motor valve and to these is also attached a lever to operate the valve stem on the oil cup. This arrangement of the controlling mechanism provides for an automatic lubrication to the motor only when the hoist is being used. The worm and worm wheel are respectively of steel and phosphor bronze enclosed in an oil tight case and all parts of the hoist are of sufficient strength to sustain a load of twice their rated capacity. These hoists are made in three sizes to lift from one to five tons from eight to ten feet high.

The illustration, Fig. 2, shows the adaptability of the motor for changing machinery from hand to power equipment. The derrick hoist outfit is now being built for a hoisting capacity

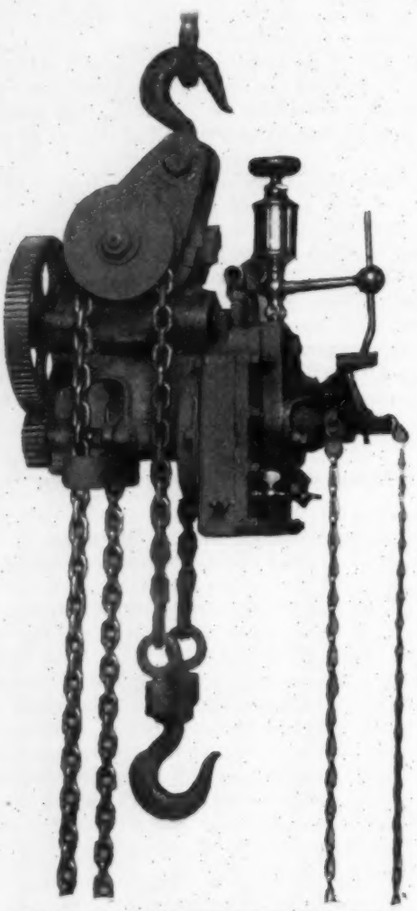


FIG. 1.—THE DAKE PNEUMATIC CHAIN HOIST.

of from three to five tons, two sizes, and can be readily bolted to the derrick mast as illustrated. The bed of this machine is slotted so that the bolts can be shifted in order to allow the machine to be adjusted to masts of from 10 to 18 inch face.

The compactness of the engine is also shown in the illustration of the small hoist for mining or contractors' service, which is seen in Fig. 3. These are built in several sizes from 5 to 20 horsepower.

The company also builds a swinging engine or gear to be used in connection with a double drum hoisting engine. This auxiliary machine is bolted to the skids or frame on which the hoisting engine rests, these being extended out a sufficient length to take the swinging engine. Some experimental work has been done on these rigs by the contractors working on the subway in New York and the Dake Engine Co. is now building six improved machines for work there and on Boston contracts.

FIG. 2.—DAKE ENGINE ATTACHED TO DERRICK HOIST.

The details of the Dake square piston engine are shown in Fig. 4. On the left is the cover plate which has been removed from the engine frame seen on the right. The crank shaft is shown in position and the vertical and horizontal slides show clearly the manner in which the crank is rotated. The screw at the lower right hand corner of the engine is used for taking up any wear in the slides. The reversal of the engine is accomplished by changing the relative position of the inlet and exhaust ports by a simple contrivance.

Trustee McKeefry of the Continental Iron Co., Youngstown, has submitted a report to the bankruptcy referee which shows that the mill as now operated by the trustee is paying off the indebtedness of the concern at the rate of from $4,000 to $5,000 per month. Creditors are highly pleased by the report.

The American Tube & Stamping Co., Bridgeport, Ct., will issue bonds for $1,500,000 to pay for extensive addi

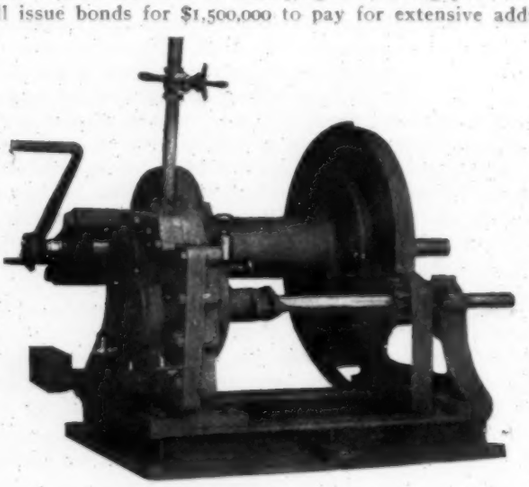


FIG. 3.—DAKE MOTOR CONNECTED TO CONTRACTOR'S HOIST.

tions to the plant, including an open-hearth steel department and billet mill. Considerable progress has already been made in the building of the steel works.

A GERMAN VIEW OF AMERICAN INDUSTRIAL LIFE.

The United States Treasury Department has published a translation of the "Observations on the Economic Life of the United States of America," by Hon. Ludwig Max Goldberger, of Berlin, Royal Privy Councilor of Commerce and member of the Imperial German Consultative Board for Commercial Measures. Mr. Goldberger visited the United States in 1901 and 1902, spending some eight months studying industrial and commercial conditions. In the chapter on "Labor and Workshops," he says in part:

"A sort of fanaticism for work seems to have taken hold of men. Labor is so intense in the centers of industry that, barring sleep, it permits scarcely of any other recreation, and for that reason places of worldly pleasure, if we except large towns, are very rare. Where there is any money to be made by commercial activities even in very small and distant places you find hotels, equipped with all comforts and surprising glitter. The places of rest or recreation, on the other hand, have but tolerable hotels, bad roads, and defective means of communication. The general restlessness excludes recreation, but this the American business man does not seek at home. If he has saved money and wants to rest and enjoy himself for a short time he goes to Europe. In his own country he knows of barely anything but business, to such an extent that, even of the wealthy, only very few have seen the beauties of nature in their own country. Only a small part of the inhabitants of the East has ever seen the sunny country of the Far West, with its buds and flowers, its vineyards, its mild and clear skies, its palms and oranges. The fanatic desire for work of which I have just spoken begins already in early youth, and almost as young as the industry of the country are the leaders of large enterprises, many of them mere boys. On the other hand, there are few men who stop work and retire to live on their income, even when they have earned millions.

"Just as there are no restrictions on the internal economic development, so there is among men themselves the greatest freedom of intercourse, though sometimes in forms which seem strange to us. Between the temporary rulers and the people there are, of course, entirely different relations and forms of intercourse from those that exist in monarchies, and, since everything in the United States is still much newer, I venture to state that these forms are even more free and unregulated than in the republics of the Old World. From the above it can be readily perceived that the respect for authority is not overdeveloped in the United States, and for this reason purely friendly relations can hardly ever arise between employers and workmen. I was peculiarly struck while inspecting the San Francisco Union Iron Works, in company of Mr. Irving Scott, the founder of these works, when I noticed, that of the workmen whom we met on the way to their noonday meal scarcely one raised his cap to that honorable gentleman who had grown gray in his profession, and is now truly an honor to American industry; and yet they all knew Irving Scott. On the other hand, pensions and old-age provisions are given in the very rarest instances in industrial enterprises. Whoever can no longer work as efficiently as when he was young, even if he has grown old in the same house, has got to go; he is discharged regardless of former services and must give way to younger men who are more efficient. The needs of commerce require it and nothing else is to be considered.

"But one must have seen the people of the United States at work to clearly understand what they have accomplished and still continue to accomplish. Machinery on all sides, in order to produce on a large scale, and the division of labor so thoroughly applied that in the end man has turned either a machine or an overseer of a machine. In Europe the independent individuality has been the noble and beautiful result of long historical evolution. In America, on the contrary, we find from the very beginning the largest amount of freedom, coupled with hard economic necessity, self assertion and independence, recognizing human restraint but in the most restricted manner curiously joined with conscious and ruthless aim and purpose, which brings it about that a people composed of self-ruling individuals, while occupied in industry, have resigned their claims to all individual life and subordinated themselves entirely to the industrial aim for the attainment of which they happen to work. Wherever it is possible to transmute a piece of work into separate operations, every single operation becomes a specialty, because thereby an expert knowledge is gained which gives a greater skill in this operation and make possible its more rapid repetition within a certain space of time."

Club House for Cleveland-Cliffs Co. Employes.

The Cleveland Cliffs Iron Co. has opened the club house built at Gladstone, Mich., for its employes. At the opening, President W. G. Mather, of Cleveland, made a short address. Beer will be sold in addition to other refreshments at cost, three cents per glass. Treating, however, or excessive drinking will not be permitted. Every man must pay for his own food and drink. Cigars will be sold for three and seven cents. By eliminating the factor of treating the company hopes to decrease intoxication and gambling. The club house is fitted up with pool and billiard tables and a large reading room on whose tables are eighteen magazines and periodicals in both the English and foreign languages. The aim of the company is to benefit the laborer socially and financially. No fee is attached to the club house but it is exclusively for employes of the company.

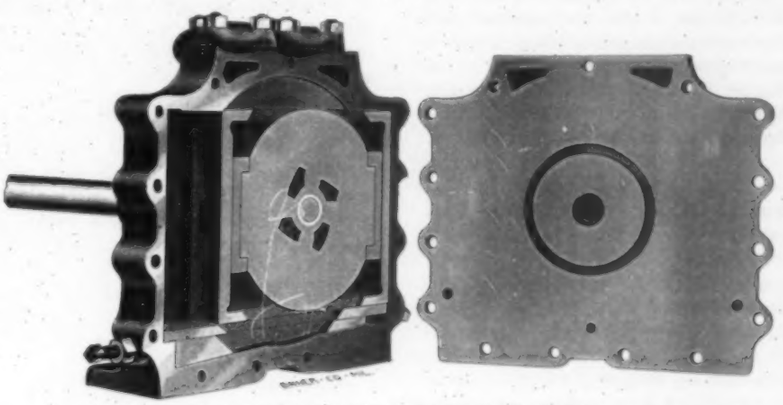


FIG. 4.—INTERIOR VIEW OF THE DAKE ENGINE.

The Steel Basket Co., of Cedar Rapids, Iowa, manufactures a number of metal specialties, including corrugated safety cans for oily rags and waste, galvanized steel hoisting buckets, stock yard baskets, park baskets, etc. From modest beginnings the industry has developed into very considerable proportions.

At Springfield, Mass., last week, an injunction was ordered by Judge William C. Wait restraining the Moore Drop Forging Co. from so conducting its business as to be a nuisance by reason of noise, vibration and smoke, to adjoining property owners. The judges made no finding in regard to damages. The court said that the noise and vibration were necessary concomitants to drop forging, but that they constituted a nuisance within the legal meaning of the term.

PREMIUM AND PIECE-WORK WAGE SYSTEMS.

The "Premium System of Wage Payment" is the title of an article in the January *Annals of the American Academy of Political and Social Science*, by A. E. Outerbridge, Jr., of Philadelphia. The question of priority is of little consequence in comparison with the other matters involved, but it is unfortunate that a more definite distinction between the methods respectively devised and advocated by Fred W. Taylor and F. A. Halsey, has not been made. Very many people credit Mr. Halsey in fact with being an early worker in this field, probably prior to Mr. Taylor's work at South Bethlehem and elsewhere; but no mention of this pioneer labor is linked to the former's name. The two systems are essentially different and can only be joined together under the broad gauge classification of plans for economically increasing productive labor; the stimulus being the enhanced value of the workman, with a relative reward; the greater worth of the workman reducing the cost per piece and the division of gain between employer and employe making for permanency of remuneration. The following extracts are taken from Mr. Outerbridge's article which begins with a recital of the difficulties in the way of profit-sharing systems and then passes to the later methods:

Differential and the Piece-Work Systems.

"In my judgment, the best way to solve the problem is to make every man the treasurer of his own time, and the only practical way to do this is to pay the largest premium in addition to the standard wage rate for the largest individual output. The piece-work system was devised with this in mind, but in its original form it is open to one serious objection, which always will exist, and that is that the workman fears that if he does more than a certain amount in a day, sooner or later the piece-work price will be cut and the result will be that he will have to work harder than before to acquire the same amount of money. While there are different methods in vogue, adapted to different circumstances, the premium system consists essentially of the addition of a premium to the base price agreed upon for any job, the amount of the premium depending upon the reduction of time in performing the work. The method of remuneration differs radically from the ordinary piece-work system of payment, for it makes each workman's interest the same as that of his employer; it pays a premium for high efficiency, and soon convinces each man that it is for his permanent advantage to turn out each day the best quality and maximum quantity of work. Briefly stated, then, the premium system consists in paying *a higher rate per piece for a greater amount of work done without imperfection in a given time*. Several years ago Mr. Fred W. Taylor devised and put into practical operation at the Midvale Steel Works a premium piece-work plan which he called the 'differential system.' This may, perhaps, be regarded as the pioneer of all the premium systems in use today, and it proved immediately successful. The following illustration, representing actual results obtained in daily work, will show the economy of high wages under Mr. Taylor's differential system as applied to turning certain steel forgings, of which many thousands were made:

Cost of Production Per Lathe Per Day.

ORDINARY PIECE-WORK SYSTEM.		DIFFERENTIAL RATE SYSTEM.	
Man's wages	$2 50	Man's wages	$3 50
Machine cost	3 37	Machine cost	3 37
Total cost per day..	$5 87	Total cost per day..	$6 87
Five pieces produced; cost per piece.....	1 17	Ten pieces produced; cost per piece	69

"To explain further the difference between the simple piece-work system and the premium system reference may be made to a case where new work was introduced into an establishment undertaking an entirely new kind of manufacture. The concern had never done the work before, so did not know at all what it was going to cost. Parts of the machines were given out to the different departments to be made by day's work, because nobody knew what the cost was liable to be. The people selected to work by the day were the men who were considered the quickest and best workmen in the establishment, who would be likely to make those parts under the system of day's work as cheaply as they could be made, so that the actual cost of making them in this way might be made the basis for a piece-work price. Quite a large number of the parts were made by day's work. I saw some of the work being done myself, and did not observe anything that led me to believe that there was any loafing on the part of the men. A piece price was finally fixed based upon the average cost by day's work. After the men got more skilled in their jobs they did a little better, but the average was taken for the piece-work price. It so happened that some precisely similar things were made in another establishment, and through an accident it was ascertained that an article which cost about $24 to make under this system of piece-work cost about $13 to make in the other establishment where a premium system was in vogue. An investigation showed that the actual amount of labor required to make the pieces was the same in each foundry, but in one the simple piece-work system of pay obtained; in the other a premium system. Then an entire change of personnel in the department, including the foreman, was made; new men were engaged to do the work on a premium system and the result was surprising. In a very short time the new men were making nearly double the wages of the former operatives and the cost per piece was reduced nearly one-half.

Tools Not Spared.

"This system, of course, does not spare the tools, which are run at a high rate, and, since its introduction, the views of progressive manufacturers regarding the economical use of machine tools have materially changed. Formerly old tools were venerated and carefully preserved as long as they could be used. Now the aim is to obtain the full life-service in the shortest possible time, and then to consign the tool to the scrap heap. In this way tools are worn out long before they have become obsolete in design. 'Soldiering' on the part of the operatives is effectually eliminated, wages are raised, the output increased and cost of production is decreased in an amazing ratio. All this is accomplished without exhausting toil on the part of the operative, for the machine has relieved him of most of the hard work; especially is this noticeable in handling heavy materials. In former days rupture was very common indeed among molders in foundries, caused by frequent severe straining in lifting flasks and molds; now it is a rare thing to find rupture among the younger molders, owing to the fact that in all modern foundries traveling cranes and other hoisting appliances are provided for lifting heavy materials and carrying them from one place to another.

"Within my own experience there has been a great improvement in this respect. I can recollect at least six molders in one foundry who were badly ruptured from lifting their molds, while today I never hear of this trouble, for the main cause has been removed. The mechanic of today, who is engaged, for instance, in riveting a boiler or a bridge structure, no longer spends 10 hours a day in striking blows with monotonous regularity upon the rivet heads, but he is employed to control the steam or hydraulic riveting machine, a sort of giant hand, which presses the red hot rivet into place with a simple silent squeeze of its powerful finger far more effectually than can be done by two strong men striking 100 blows each with a riveter's hammer. This has been proved by official tests.

"Certain conditions are necessary for success of any system. There are laws regarding the relation between employers and employes which are immutable, and the most fundamental of these laws is that mutual confidence and respect are necessary precedents to the inauguration of any marked change in the methods of management or the conditions of payment. Such confidence is especially important when changes are made from time wages to some form of piece wages intended to increase the output by increasing the inducement to labor. Workmen are invariably suspicious of such changes. They fear that the piece rate will be cut as soon as the capacity of the worker has been shown. Without the fullest confidence in the good intentions of the employer, therefore, so radical a reform as the one suggested can with great difficulty be introduced. Employers can acquire and retain this confidence by courtesy, by fair dealing, by providing healthful and pleasant surroundings for their employes and by protecting them and their families against the consequences of sickness or accident.

Care for the Welfare of Employes.

"Another important consideration making for the successful establishment of such innovations as the premium system is a care for the well being of the employes. In my discussion of business and philanthropy I do not wish to be misunderstood, or to seem to underrate the advantages which may accrue to employes, as well as to employers, of philanthropic plans devised for the aid of sick, injured or infirm operatives. In one of the largest and most successful manufacturing establishments in the world an admirable system is in vogue, whereby unfortunate men are helped in time of need, but so judiciously and secretly is this done that the world knows nothing about it, and if I should name the establishment it would violate confidences that I have received, not from the managers of the works, but from men who have been thus aided in a way which has not awakened any other feeling than that of gratitude. You cannot find any allusion to these matters in the rules posted up in the works, and, in fact, I believe there are no rules on that subject. There is no contract in existence; there is no guarantee that if a man is injured, or if he is sick, or in trouble, that the helping hand will be extended to him, yet I doubt not that every one of the thousands of men employed in those shops goes to his daily work with a contented feeling that should an accident befall him while on duty, his family would be cared for while he might be incapacitated for work. It thus appears evident from whatever point of view the question may be studied that the value of the 'personal equation' in management of large industrial works is a most important factor in the successful conduct of affairs.

Room for Foundry Betterments.

"Moreover, my views are pronouncedly towards recognizing the responsibility which rests upon the employer to the fullest extent practicable, not, however, based upon philanthropic grounds, but because observation has taught me that one of the most profitable investments of money that can be made in a manufacturing plant is to give the largest possible advantages, in the way of conveniences and sanitary arrangements, etc., to the operatives. I remember years ago finding it a difficult matter to impress upon the superintendent of a foundry the importance of having the windows washed. They had not been washed for years, and on dark winter days the dimness in the foundry necessitated artificial light; indeed at all times the conditions were bad for the eyes of the molders. I had a great deal of trouble to get those windows washed, and yet I am quite sure that the cost was repaid in a very few days in the saving of bad work. The introduction of steam heat into another foundry that I am familiar with was a source of expense that the managers were loth to incur, but that was also a profitable improvement; it avoided irritating and blinding smoke in the foundry on cold mornings caused by lighting woodshavings on the dirt floor; not only did it contribute to the comfort of the men, but the steam heat kept the sand warm, and the molds did not crumble as formerly by reason of freezing of the moisture in the sand on cold nights. The introduction of shower baths, dressing rooms, water closets, and other similar comforts and conveniences, improves the character of the work and conserves the health of the workmen. I maintain that every operative who gets sick in the employ of a concern, causes more or less loss, even though he may receive no wages during the time he is incapacitated for work; another and presumably an inferior or less experienced man must be put in his place and the interests of the firm must therefore suffer. For this reason I believe that every kind of legitimate comfort and convenience that may be provided for the operatives is a source of profit to the employer although apart from the moral obligation to care for the health and comfort of the employe.

Attitude of the Labor Unions.

"There is one impending menace to the continued success of the premium system. That is the arbitrary and short-sighted policy of some of the labor unions, which are continually striving to curtail the activities of labor by limiting the work of the more competent members of the union to the capacity of the less competent or more indolent members. This is certainly detrimental to progress. The immediate result of such methods is to antagonize the employer, who does not object to labor unions when they confine their activities to lgeitimate fields of usefulness. It was just such dictatorial methods of the labor unions in Great Britain that precipitated the great and disastrous strikes of mechanics a few years ago. The loss in wages alone, though amounting to millions of dollars, was small as compared with the permanent loss sustained by the manufacturing industries in that country, caused directly by the preposterous acts of the labor unions. The ostensible ground on which this policy of the labor leaders is defended is that there is only so much work to be done and that if a machine is introduced in place of a man, or if machines are run at higher speed, the aggregate earnings of labor will be reduced. The absurdity of this opinion is by this time sufficiently apparent.

"If it were not for the assistance of costly mechanical aids, so freely furnished to operatives, enabling them in many cases to quadruple the effect of their efforts, the American mechanic would be today making less wages, while having harder work; the output from the workshops would be smaller, and the general prosperity of the country would be less marked. If it were not for these mechanical aids the premium system would not have been developed and the true policy of the labor unions should be to foster this system in every way.

"It may seem anomalous to say that the higher the class of labor in manufacturing establishments the cheaper the product, yet this has been proved time and again, and it has come to pass through the aid of machinery. The 'skilled' workman of today in almost any trade is a man who can so deftly and judiciously operate a machine, or a number of machines (representing often an investment of many thousands of dollars), that the output is largely increased thereby, without necessarily increasing unduly his own physical or mental labor; the employer can well aflord, therefore, to offer large pecuniary inducements in the shape of premiums to the most productive operators.

"An impression has prevailed in the minds of many intelligent people, especially those not engaged in mechanical pursuits, that the substitution of so called automatic machinery for hand labor it detrimental to the intellectual development of the wage earner, tending to make him a mere automaton, like the machine which he tends; that the skilled handicraftsman of former generations is fast disappearing, and that his successor is becoming a mere marionette, to whom the gift of brains is almost a superfluity. Daily observation in large industrial works extending over a score of years, has led me to form a different conclusion. I believe it is now generally admitted that the educational influence, upon the mind of the operative, of daily contact with machinery is a potent one, enlarging his mental horizon, giving him more accurate perceptions of the true relation of parts and fitness of things, and elevating him intellectually above the place of the old time handicraftsman. The machine once regarded as the robber of the wage earner is destined to become, indeed, has already become the missionary for his enlightenment; and when its advantages are fully appreciated in the labor world the conflicts which have marked the transition period will become a mere memory of a past era. Just as every new invention in scientific mechanism of warfare is a step towards the ultimate settlement of international disputes by arbitration, so the general diffusion of knowledge among the wage earning class through the aid of machinery and its products, is a step towards the settlement by peaceful processes of the complex questions which will, without doubt, continue to arise in the future regarding the mutual relations of capital and labor.

Increases in wages aggregating $600,000 a year are to be granted the 5,000 locomotive enginers and firemen employed by the Chicago & Northwestern railroad and its branch lines through an agreement reached Dec. 19 between officials of the railroads and committees representing the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen. The new scale will go into effect Jan. 1. It provides for increases of approximately 8 percent in the pay of the members of the labor organizations. The engineers will receive from $3.80 to $4.70 for each run of 100 miles. They are now paid from $3.70 to $4.30.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of their Wants:—

F. L. Doolittle, H. M. Sams, M. E. Brown, J. C. Miller and E. J. Harvie have incorporated the Maxon-Miller Jack Co., Huntington, W. Va., to manufacture lifting jacks. Capital stock is $10,000.

United Supply & Mfg. Co., Chicago, has been incorporated, capital, $50,000, to manufacture machinery and railroad supplies; incorporators, Jacob Buchofsky, G. C. Klopf, F. A. Wrigley.

The Sacramento Foundry & Machine Works, Sacramento, Cal., have been incorporated. Directors, L. Wilson, J. H. Stocker, A. Biggi, Jr., P. J. Root and H. Runckel. Capital stock, $15,000; subscribed, $8,002.

Dan Valley Brick Co., Danville, Ky., wants good second-hand 75-horsepower tubular boiler.

P. H. Wilson, Olean, N. Y., will need 200-horsepower automatic engine, 100-horsepower horizontal tubular boiler, 140 feet of 2 15-16 shafting, 300 feet of 1 15-16 shafting, and hangers.

The firm of Borger Bros., Columbus, O., has been incorporated as the Borger Bros. Co., capital $50,000; by Samuel Borger, Geo. Borger, Peter Borger, Chas. Borger, Isaac H. Robinson and John Borger. The company will manufacture, buy, sell and deal in boilers, engines, machinery, etc.

The Southwestern Fuel & Iron Co., Silverton, Colo., has been incorporated and will erect a large Gage reduction plant at Silverton and an electric plant of 1,500 horsepower at Bear Creek. The electric transmission lines will be built from Silverton up to Animas, Cement and Mineral creeks, to operate the company's mines. A track will be built from Bear Creek to the works at Silverton. At Farmington it is proposed to build a steel plant. Among those interested are Chas. H. Gage, of the Gage Reduction Process, who is president of the new company; H. C. Frick, chairman of the board of control, and J. E. Krepps, secretary-treasurer.

The Shawd Gas Engine Co., Springfield, O., will be incorporated in a few days under the laws of West Virginia with a capital of $50,000. The company will need equipment soon after Jan. 1. The product will be gas and gasoline engines of 2, 4 and 6 horsepower.

The Marvin Coal & Coke Co., Matewan, W. Va., recently incorporated with $25,000 capital, has leased and will develop 2,500 acres of coal land.

The Bessemer Coal, Coke & R. R. Co., Bessemer, Ala., has been incorporated by Benjamin F. Baxley, W. A. McWhorter, W. E. Tilton, Lucy A. Baxley, W. B. Acker and W. H. Heldman. The capitalization is $500,000. Company proposes to mine coal and manufacture coke and coal tar.

The Union Iron Works, Mobile, Ala., recently organized, is now equipping plant; Richard Murray, president, and C. G. Oswald, manager.

The Meadville Malleable Iron Co., Meadville, Pa., whose stockholders recently decided to increase its capital to $150,000 and to enlarge the plant early in the new year, is not yet in the market for equipment and is not now ready to announce its plans in detail.

The Hawkeye Steel Tank Works, Iowa City, Iowa, which started on a small scale a year ago, have been doing a large business and will increase capacity after the first of the new year.

Bowen & Street, Norfolk, Va., are in market for car wheel press, car wheel boring machine, large locomotive lathe to swing 62 inches, steam hammer and overhead traveling crane.

Savannah Locomotive Works, Savannah, Ga., wants light locomotive (either Shay, Fifield or Climax build) suitable for wood and iron rail (dealer's price).

Peacock's Iron Works, Selma, Ala., will buy a light small logging locomotive for wooden tracks, standard gauge, to be delivered at Vicksburg, Miss.

The Warren Brass Co., Warren, O., recently incorporated with a capital of $30,000, does not intend to put up any new buildings at present, having purchased a plant which was partially equipped. The plant has been remodeled so that it answers present requirements. The company is manufacturing brass goods for plumbing use.

John D. Mack and A. C. Blinn have bought the plant and the business of the Crandall Fence & Iron Co., Sandusky, O. The building is 96x50 feet and the lot 66x200 feet. The building is equipped with machinery for the manufacture of iron fencing, fire escapes, iron and steel stairways and like materials. It is the intention of the new owners to extend the business. Mr. Mack will be the business manager.

In addition to the extensions now being built to the ordnance shops at the League Island Navy Yard, Philadelphia, sites will be selected after the first of the year for a foundry, a coppersmith shop, a steam engineering building and a sheet steel building for locomotive crane machinery. Estimates have already been asked and contracts awarded for all of the work, which will cost, exclusive of the equipment, more than $500,000.

The directors of the Owen Machine Tool Co., Akron, O., have decided to increase the capital stock from $50,000 to $65,000. The company is now ready to move into its new plant and expects to increase its force to over 100 men. All the new machinery is in place.

J. P. Moser will establish a machine shop and foundry at Okahumpka, Fla.

The Carolina Steel Bridge Co., Burlington, N. C., has been incorporated with a capital of $250,000 to build bridges, etc.

The United States Supply & Manufacturing Co., of Chicago, Ill., has been incorporated with $25,000 capital for the purpose of engaging in the manufacture of machinery and railway supplies. Jacob Buchofsky, G. C. Klopf and F. A. Wrigley are the incorporators.

The Sizer Forge Co., of Brooklyn, N. Y., has been incorporated with $300,000 capital for the purpose of engaging in the manufacture of iron and steel forgings. H. S. and W. S. Sizer and J. Y. Sloan are the incorporators.

The Cullen Iron & Manufacturing Co., of Duluth, Minn., of which Richard Cullen, of Duluth, is president and majority stockholder has been acquiring extensive leases on the Vermillion and Mesabi ranges. Mr. Cullen states that it is the intention of the company to erect a blast furnace at Chicago, Ill.

The Frank Voigtmann Cornice Co., of Chicago, Ill., has been incorporated with $10,000 capital for the purpose of engaging in the manufacture of cornices. John P. Noos, Peter Schmitz and John H. Hill are the incorporators.

The Love Bros. Co., Aurora, Ill., has been incorporated with a capital of $200,000 to conduct a foundry business.

The Coshocton Machine Mfg. Co., Coshocton, O., recently incorporated with a capital of $20,000, succeeds the Coshocton Machine Works. It is the company's intention to erect a plant for the manufacture of die presses and special machinery.

The Bullard Machine Tool Co., Bridgeport, Conn., has awarded to the Berlin Construction Co., a contract for the erection of an additional factory. The structure will be 40x112 feet, with steel frame and brick walls, and will be used for a setting-up department.

The Montmagny Mfg. Co., of Montmagny, Quebec, whose plant was destroyed by fire Dec. 1, is rebuilding. The new foundry will be 50 feet square with a 27-inch cupola. A six ton Harrington band traveling crane will be installed. The machine shop will be 90x50 feet with same kind of crane as the foundry. There will be 7 lathes, 2 planers, 1 shaper and 3 drill presses. This equipment has been purchased. The foundation will be laid for an eight inch horizontal boring and turning mill, which will be installed later.

Fires and Accidents:—

Fire from unknown cause at the Miller Iron Co.'s foundry, at Providence, R. I., gutted the engine room, disabling the power plant, swept the carpenter shop and burned out one pattern room. Loss on patterns, $6,000 and the total loss, $10,000; insured.

The plant of Holmes-Pyott & Co., Chicago, Ill., architectural iron manufacturers, suffered a loss of $7,500 from fire last week.

A spark from a red hot piece of metal, which was being pre-

pared at the plant of the Eastern Forge Co., at Nashua, N. H., caused a fire in the building which resulted in a loss of $5,000. The spark lodged among some oiled machinery.

The plant of the Hartford Woven Wire Mattress Co., Hartford, Conn., was badly damaged by fire last week. The loss is estimated at $25,000.

New Construction:

The Pittsburg Seamless Tube Co., Beaver Falls, Pa., is considering the installation of one or two open-hearth furnaces and a small mill to break down small ingots for tube blanks.

The Crucible Steel Co., of America, is increasing the output of its Sanderson plant at Syracuse, N. Y., by the installation of additional wire drawing capacity. Two additional 100-h. p. boilers are also being installed as well as a 200-h. p. engine.

S. G. Hunter will erect a foundry, 44x100 feet at Atlantic, Ia.

The National Malleable Iron & Steel Perfection Couple Co., Pottstown, Pa., will greatly enlarge its foundry capacity. Considerable property was recently purchased adjoining the present site of the plant.

The Standard Gauge Steel Co., of Beaver Falls, Pa., is having plans prepared for the erection of a large addition. The products of the plant consist of compressed steel, elevator guides and shaft couplings. A. Rasner is president; A. F. Dinger, treasurer and S. Moltrup, manager.

The St. Paul Foundry Co., St. Paul, Minn., contemplates the erection of additions to its plant that will cost approximately $50,000. The foundry is to be practically doubled in size while the structural fitting shop is also to be added to. A new templet shop is also to be erected.

The Christy Knife Co., Fremont, O., whose plant was recently destroyed by fire, is rebuilding and hopes to be in operation soon after the first of the year. It is the intention to make the same line as before with perhaps a few new novelties.

The Eulaton Foundry Co., Eulaton, Ala., will build a foundry. Address Box 176, Anniston, Ala.

A foundry building, 85x100; a machine shop, 95x100, and a forge shop, 38x75, will be built by the Bellefontaine Foundry & Machine Co., Bellefontaine, O., for the manufacture of hydraulic and pneumatic machinery. A 50-horsepower power plant, with generator and motors, will be installed.

The Stimpson Standard Scale Co., Milan, Mich., will build a new brick foundry, 60x60, and a factory building, 60x250. It will have composition roof, steam heat, galvanized iron skylights and electric light. W. F. Stimpson, 22 Antietam St., Detroit, is manager.

The Newton Machine Tool Works, Philadelphia, will build a machine shop addition, three story brick, 187x100 feet.

The Washington Iron Works Co., Seattle, Wash., will make improvements at its plant costing about $100,000. A new machine shop will be constructed, and an addition to the boundry built.

The Dominion Wrought Iron Wheel Co., Ltd., of Toronto, has decided to build a factory at Orrilia this winter for the manufacture of wrought iron wheels.

The Terminal Railroad Association of St. Louis, W. S. McChesney, general manager, has let the contract to the Geo. Fuller Construction Co., of Chicago, for the construction of a machine shop and power house.

The Southern Bolt & Nut Works, of Birmingham, Ala., has been consolidated with the American Bolt Co., of Lowell, Mass., and will proceed at once to erect a new plant at East Birmingham, where a site of two acres has been purchased. There will be two main buildings, 50x160 and 100x160 feet. The new company will be incorporated with a capital of $150,000 by W. H. Merritt, C. H. Merritt and Percy Parker. W. H. Merritt will be president and general manager. H. C. Brill will come from the American Iron & Steel Co., at Lebanon, Pa., to be superintendent.

Important improvements have recently been made by the Lake Shore Engine Works, Marquette, Mich. An electric crane has been ordered from Pawling & Harnischfeger, of Milwaukee. Some changes in the buildings have also been made.

The Walsh & Weidner Boiler Mfg. Co., Chattanooga, Tenn., has begun the erection of additional buildings, and will install additional machinery to double its boiler works. About $30,000 will be expended.

The Sherman Mfg. Co., Chattanooga, Tenn., manufacturer of boilers, standpipes, etc., will erect an additional machine shop and install modern machinery. About $20,000 will be expended.

The Illinois Malleable Iron Co., Chicago, will build a foundry, at a cost of $8,000.

The erection of the building for the foundry of the Hayward Foundry & Machine Co., at Monongahela, Pa., has been finished.

A site has been purchased and plans drawn for the buildings and tracks of the railroad shops which will be built at North Birmingham, Ala., by the Southern Railway. The property cost more than $50,000 and about $200,000 more will be spent on the shops.

The Pittsburg District:—

The old buildings of the Chartiers plant of the American Sheet Steel Co., Carnegie, Pa., which have been unoccupied for several years have lately been put to a new use. Several weeks ago the buildings were rented to be used as the winter quarters of a Wild West Show and the animals and performers are now in complete control of the plant. The buildings were purchased some time ago by the Pennsylvania railroad together with the site and the property will be cleared in the spring.

The Redding Engineering Co., of Pittsburg, has secured a contract from the Todd Cotton Harvester Co., of Chicago, for 350 mechanical cotton wickers to be completed in three lots during the next two years. The Redding Engineering Co. has recently greatly increased the size of its plant by the erection of additions and the installation of much new machinery. Recently the equipment, tools and patterns of the Ellwood City Gas Engine Co., Ellwood City, Pa., were purchased for $23,000 and the manufacture of this type of gas engines has already been commenced. The company is capitalized at $125,000. H. B. Redding is president and F. E. Redding is secretary and treasurer.

Interests of the Charles K. Hill Co., dealers in electrical supplies are organizing the Crescent Electric & Manufacturing Co. to have a capital of $12,000. A site for the erection of a plant to be equipped to manufacture all kinds of electrical machinery has been purchased on Second Ave. near Liberty St.

The Central Car Wheel Co., of Pittsburg, which is erecting a plant near Butler, Pa., for the manufacture of rolled steel car wheels has increased its capital from $100,000 to $300,000.

General Industrial Notes:—

The Wales Pulley Co., Swanton, O., whose capital was recently increased from $10,000 to $25,000, as noted last week, was compelled to build an addition to its plant and install new machinery within two months after beginning operations. At present the company is turning out 100 pulleys per day and after the first of the year will work over time, as it has orders ahead three months.

The Oswald Iron Works, Ltd., New Orleans, will change title to Southern Marine Works, capitalized at $50,000; Charles G. Coyle, president.

The Hamilton Coal Co., C. E. Jones, president, Chattanooga, Tenn., has purchased 19,800 acres of coal land in Hamilton county for $96,500, and will develop the mines, also erect coke ovens.

The Stark Rolling Mill, Canton, O., has been shut down till Dec. 29 to make repairs.

The Little Giant ice chipper, manufactured by the Davenport Ice Chipping Machine Co., Davenport, Ia., is a machine designed to take the place of hand tools generally applied for shaving or chipping ice. The cylinder is made of heavy cast iron, sectional wheels firmly attached to shaft, upon which are mounted toothed blades, made of extra quality of tool steel, fastened by heavy machine screws, and in a manner allowing them to be adjustable and easily admit of being replaced or sharpened when necessary.

The East St. Louis Locomotive & Machine Shop Co., re-

cently incorporated, has leased a building in East St. Louis, Ill., at 18th St. and Southern Railway, and is now remodeling it to suit its purposes, and putting in the latest improved machinery. It intends to make a specialty of repairing and rebuilding locomotives, and also will be prepared to repair steam engines, boilers, railroad cars, street cars, trucks, etc. The company expects to be in operation about Jan. 15.

The new skelp mill of the Youngstown Iron, Sheet & Tube Co. is now in operation.

The Jupiter furnace at St. Louis, Mo., has been purchased by the Southern Car & Foundry Co., of Birmingham, Ala. This stack has been idle for many years, and while the purchasers have not yet stated whether they intend to place it in repair for an early resumption of operations, it has been semi-officially stated that the machinery and engines of the plant will be removed to the South and the stack and stoves will be razed.

The new machine shop of Williams, White & Co., Moline, Ill., has been completed and much of the heavy machinery from the company's old shop has been removed to the more modern plant. All the tools are to be removed from the old shop and during the winter at least it will only be used for storage purposes.

The plant of the Oswego Boiler Works, Oswego, N. Y., has been shut down and its owners are negotiating for its sale.

Twenty mills of the Shenango plant of the American Tin Plate Co., New Castle, Pa., will be placed in operation on Monday, Dec. 29. This plant has been idle for nearly six months and was shut down at the same time that other plants of the American Tin Plate Co. were closed early in the summer owing to the large accumulation of stocks and the falling off in the demand for tin plate. These stocks, especially at New Castle, have been greatly reduced in the past few months and with an increased demand it is necessary to place twenty of the mills of this plant in operation.

The New Castle, Pa., wire and nail plants of the American Steel & Wire Co., which have been closed for more than a year, are being dismantled.

The new skelp mill of the Youngstown Iron Sheet & Tube Co., Youngstown, O., was placed in successful operation last week. All sizes of skelp can be rolled on the mill up to 15 inches. The daily capacity is estimated at 200 tons. Carl Landgren is in charge of the plant.

The Bessemer plant of the Republic Iron & Steel Co., Youngstown, O., resumed operations again last week after an idleness of about three weeks. For several months the plant has been compelled to shut down at brief periods on account of the scarcity of iron, only one of the company's four stacks located at Youngstown and New Castle being in operation on account of the scarcity of coke.

Furnace No. 3 of the Woodstock Iron Works, at Anniston, Ala., was blown in last week after an idleness of nearly six months. The furnace underwent extensive repairs and it was also considerably enlarged and it is estimated that the daily output will now be 300 tons. Should this stack reach this output it will be one of the largest furnaces in the South. Fully $500,000 was spent for repairs and new machinery. The stack is also equipped with an automatic skip hoist, doing away with the top fillers entirely.

The Franklin Steel Co., of Boston, Mass., which operates a toe-calk steel plant, has decided to remove to Joliet, Ill. The plant of the Joliet Wire Co., built in 1899, was purchased and will be equipped for the manufacture of the company's specialty. The abandoned wire mill building is 208 feet long and 60 feet wide.

The Center Foundry Co., Wheeling, W. Va., has been reorganized and the new officials have decided to manufacture a new type of gas engines designed by L. S. Kirker. Officers for the ensuing year were elected as follows: A. T. Young, president; J. H. Beans, secretary, and L. S. Kirker, general manager. The above officials, together with George Wise, N. E. Whitaker, and C. R. Hubbard, comprise the board of directors.

C. W. Bennett, Western district manager of the American Tin Plate Co., with headquarters at Anderson, Ind., officially denies that the bar mill at Elwood, Ind., will be removed to New Castle, Pa., and that the plants at Gas City, Anderson and Middletown would be consolidated with the Elwood plant.

The drawing and bale wire departments of the Dillon-Griswold Wire Co., Sterling, Ill., resumed operations this week aften an extended idleness. H. C. Wicker, manager of the plant, states that sufficient orders are now on hand to operate the plant during the next six months.

The Cleveland Punch & Shear Works Co., Cleveland, has been awarded a large contract for machine tools to be installed in the new shipbuilding plant at Detroit of the Great Lakes Engineering Co. The contract calls for twenty-eight machines, consisting of "Cleveland" punches, shears, rolls, plate planers, radial drills, etc. The order aggregates about $50,000, and is one of the largest contracts awarded this year in this line. The Cleveland company won in competition with a number of other concerns which manufacture machine tools.

The Waterloo Gasoline Engine Co., Waterloo, Iowa, has just passed the most successful business year since the organization of the company and is taking steps for re-incorporation and increasing the capital stock from $40,000.00 to $150,000.00. The new arrangement will include the consolidation of the Waterloo Gasoline Engine Co. and the Davis Gasoline Engine Co. into one company, to be known as the Waterloo Motor Works, which will manufacture a full line of automobiles, stationary, portable, and pumping gasoline engines.

At the plant of the Coxey Steel & Silica Sand Co., Mt. Vernon, O., work was begun last week on a 25-ton acid open hearth furnace, which, it is expected, will be completed by Feb. 1, at which time the main building will also be completed and a force of 200 more men will be put to work. The company is now employing about 200 men.

The plant of the Lebanon Iron & Steel Co., Lebanon, Pa., is now being operated by the receivers. Under an agreement with creditors the plant will not be sold. Its earnings will be used to pay the liabilities.

Engineers' Society of Western Pennsylvania.

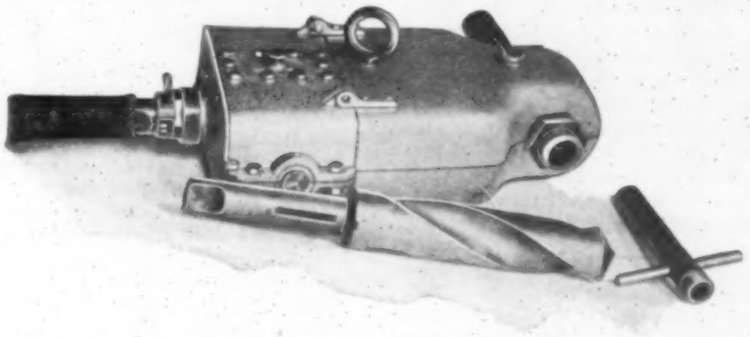
At the meeting of the Engineers' Society of Western Pennsylvania, held on Tuesday evening, Dec. 16, Chester B. Albree gave an interesting talk on the construction of pneumatic riveters and he told about the difficulties he was compelled to overcome in the designing and construction of the riveting machines his concern now has on the market. William Metcalf gave an interesting talk on the construction of steel plants forty years ago and he compared methods in vogue at that time with those of today. The annual meeting of the society will be held on Thursday evening, Jan. 8. Reports of various important achievements in the mechanical world during the past year will be read and the year's work will be reviewed in the president's annual address. At the last meeting the following were admitted to membership in the Society: Robert M. Allen, Westinghouse Machine Co.; Wilbur Altman, Pittsburg Shear Knife & Machine Co.; William Jacob Auburn, Westinghouse Machine Co.; Minot C. Blest, Pressed Steel Car Co.; Samuel A. Scott, Monongahela River Coal and Coke Co.; Edwin C. Shaw, the B. F. Goodrich Co., Akron, O.; Arnold Stucki, Pressed Steel Car Co.; David H. Childs, Pittsburg Reduction Co.; George L. Collord, Clairton Steel Co.; David C. Creese, superintendent building construction; Charles C. Goodrich, the B. F. Goodrich Co., Akron, O.; Vasil Y. Grebennikov, Jones & Laughlin Co.; Alfred E. Hess, Pittsburg, McKeesport & Connellsville Railway Co.; Walter Kennedy, consulting engineer; Harry A. Metzler, assistant superintendent building construction; John J. Muir, mechanical engineer.

It is reported at Springfield, O., that the new consolidation of companies manufacturing grain drills will be perfected by Jan. 1, and that the capital will be $20,000,000. The companies which, it is reported, will enter the combine are: The Superior Drill Co. and the P. P. Mast Co., of Springfield; the Hoosier Drill Co., of Richmond, Ind.; the Empire Drill Co., of Shortsville, N. Y.; Brennan & Co., of Louisville, Ky.; the Dowagiac Mafg. Co., of Dowagiac, Mich., and the Blickford & Huffman Co., of Macedon, N. Y.

THE HELWIG REVERSIBLE PNEUMATIC MOTOR.

The cut illustrates a reversible pneumatic motor in connection with means to rotate a spindle in which may be fitted different kinds of tools used in the construction of ships, boilers, bridges, engines and other machinery. It possesses a number of new features and, as will be seen, the spindle is through the extreme end so it can be operated in very close quarters. The aluminum casing has a hinged lid so that the machinery may be readily inspected, cleaned by air blast and oiled thoroughly at pleasure. The motor has two oscillating cylinders made of bronze. These take air at both ends, and the admission and exhaust are controlled by the oscillating movement. The trunnions have steel ferules to protect them from wear. In the main frame there are two air chests (one on each side), one for live air and the other for exhaust, and by turning the handle half way around, the functions of these chests are changed, thereby reversing the motion and readily controlling the action. By a quarter turn of the handle the motion ceases. The air is admitted and exhausted through the handle backward from the operator so that the current will not blow out lights. It has an adjustable collar which can be set so that the motor runs but one way only. The detachable handle is used when the drill is suspended or when used for tapping and reaming.

The largest motor of this type at present built weighs 33 pounds and develops about 2 horsepower under 90 pounds pressure, consuming about 17 cubic feet of free air per minute. The maximum speed for the drill spindle is about 200 revolutions per minute under 100 pounds pressure. The speed can be controlled by the handle or throttle to suit requirements.



THE HELWIG REVERSIBLE PNEUMATIC MOTOR.

This motor has been in actual service for over three years and has given satisfaction. The appliance can be used in locomotive fire boxes to expand all the flues in the sheet with self-feeding expanders, drilling door sheets, and holes in flanges of I-beams by setting point of feed sleeve against the one flange and the drill in the other. The firm has another type, a central spindle drill which has the same actuating mechanism as the end drill, but differently geared and cased, and is convenient for tapping and reaming, as well as for drilling. The manufacturers are the Helwig Mfg. Co., St. Paul, Minn.

The Cleveland Cliffs Iron Co. is about to install an electric power distribution system for operating mixers and blowers in its Gladstone, Mich., plant. It has recently purchased from the Westinghouse Electric & Mfg. Co. two 75-kilowatt, direct-current generators and eight 10-h. p., direct-current motors. The Pioneer Iron Works, of Marquette, Mich., owned by the Cleveland Cliffs Co., will also be equipped with electrical apparatus, which will be used for the operation of mixers and blowers, as in the Gladstone plant. Apparatus recently purchased from the Westinghouse Electric & Mfg. Co. for the Marquette plant includes ten 10-h. p. direct-current motors and two 150-kilowatt, engine-type generators to be direct connected to two Westinghouse compound condensing engines. The company has also ordered a Baldwin-Westinghouse electric locomotive to be used for shifting cars in its yards.

The Mitchell Skein & Foundry Co., Chicago, sustained a loss of $15,000 by fire at its plant Dec. 14.

The plant of the American Steel Hoop Co., at Greenville, Pa., has been closed in order to make extensive improvements.

AMERICAN MACHINERY IN GERMANY.

Consul-General Frank H. Mason, writing from Berlin, Germany, concerning "salable American products in Germany," makes the following observations concerning machine tools and machinery:

It is well known that Germany is now passing through a period of industrial depression, and has to a great extent restricted the erection of new manufacturing establishments which, during the period of 1898 to 1900, made such large demands on the purveyors of American machinery and tools. It is also true that those imported lathes, planers, milling, and other machines have been used to reproduce themselves and to make many kinds of machinery and tools so excellent in quality and cheap in cost, that Germany has become a self-supplying exporter of many such appliances which were formerly imported from the United States. But while all this is true, there is still a demand in this country for many special forms of machinery and other manufactures of iron, which is only apparent to those directly concerned in that class of trade. From a leading house of this class, whose specialty is the newer forms of American machinery, the following resume of the more obvious recent demands has been obtained:

In Berlin and its vicinity, there is a call for the most improved machinery for making bolts, screws, rivets, and all that is included under the general category of boiler fittings. One firm will take six sets of such machinery, which must be of the latest and most improved construction. Steam pumps of a capacity to lift about 15,000 gallons per hour, with minimum outlay of power, would also be found salable in this country.

Machines for pressing oil from linseed, rape, sesame, palm, and other oleaginous seeds and nuts, are understood here to be made of high efficiency and relatively cheap in the United States. So far as is known, the American machinery of this class has not been introduced here, and there would seem to be a promising field for it.

German rolling mill managers now use phosphor bronze, Babbitt metal, and brass for the bearings, as journal boxes of rolls, which, as is well known, are subject to heavy frictional strain when large masses of metal pass between the rolls. It appears that none of the alloys now used for roll bearings are satisfactory, and as a German iron master said recently, "If your people have anything new and better than what we are using, they could sell a shipload of it in Germany."

There are also inquiries for American tool steel, the superior quality of which has been revealed by the vast number of American machine tools and implements now in use here. But there seems to be a difficulty in obtaining a supply, or even quotations, from the makers of such steel in the United States. It is also well known that certain grades of American steel specially adapted for the construction of dynamos and other forms of electrical machinery are superior to anything produced and used for the same purpose here. As long as there was a large export of American electrical machinery to Germany, there would be, of course, no object in offering such materials, but now that this country has become self-supplying in that line, it may be worth while to cultivate and cater to

the very tangible demand here for the specially prepared metals which are adapted to such manufacture.

Certain American firms, like the National Cash Register and Columbia Phonograph companies, which are represented here by large and finely appointed branch houses, have attracted great attention by the originality, ingenuity, and attractiveness of certain advertising devices which have been used in their show windows to draw the attention of the passing throng. In general, it may be stated that all such novelties adapted to advertising purposes, which are original and attractive, are in demand and will be found salable in this country. The same is true of many novelties for kitchen and household use, such as paring machines, carpet sweepers, wringers, ice cream freezers, naphtha stoves, etc.

Among the correspondence received here through the American Machinery Co., of No. 74 Linden Strasse, Berlin, is a letter from a large and important firm in Warsaw, which has branch houses in Moscow, St. Petersburg, Odessa, and other trade centers, and does an extensive business throughout European Russia. The letter specifies in order the classes of machinery and various special kinds of apparatus which are now demanded by their Russian trade, for a supply of which they would gladly receive proposals from American manufacturers and exporters, viz, pumping and hoisting machinery, engines, boring and drilling machines for mines and blast furnaces, stationary and portable steam engines for factory and agricultural purposes, locomobiles and thrashing machines, gas motors, power pumps, equipment for grain elevators, slaughterhouses, and steam laundries, complete apparatus for creameries and the manufacture of butter and cheese, steam heating and ventilating appliances, locomotives for small auxiliary railways, and wagons with automatic discharging devices for loads of grain, seeds, and other firmly divided materials. Catalogues, circulars, or proposals concerning any of the above classes of merchandise will, if received here, be forwarded to where they will receive due attention.

At the regular meeting of the New England Railroad Club, at the Pierce Hall, Boston, on December 9, a paper on "Electrically Driven Shops" was presented by Mr. Robert L. Warner, Boston sales manager of the Westinghouse Electric & Mfg. Co. Mr. Wagner's paper was illustrated by a large selection of stereopticon views showing many examples of the application of direct current and induction motors to the driving of machine shop tools and other apparatus.

The Crane Co., of Chicago, has given each of its 4,000 employes, as a Christmas gift, an amount equal to 5 percent of his annual wages. The total distributed was $135,000. Mr. Crane was at one time a mechanic. In 1855 he went to Chicago and opened a small brass foundry. Now he is the head of the immense plants which manufacture over 7,000 different articles for steam and gas fitters.

The Erie railroad will spend about $50,000 at Cleveland in rearranging the handling of ore. Whiskey Island will be cleared of the vast accumulation of ore and the large area occupied by the ore will be the future site of a railroad yard into which all the available empty cars will be run as fast as they can be handled. The ore will hereafter be piled at Randall Station. The expenditures at Randall will amount to $100,000. The storing capacity will be increased to 6,000,000 tons. New sidings will be laid at Mantua, Leavittsburg and other points. The total cost of the improvements will be over $300,000. It is expected that the work will be completed for the most part by the time navigation opens.

Among recent orders for locomotives are the following: Alabama Great Southern, 4, Baldwin Works; Chicago, Burlington & Quincy, 25, Baldwin Works; Grand Trunk, 25, at its Point St. Charles Works; New York, New Haven & Hartford, 15, American Locomotive Co.; New York, Chicago & St. Louis, 15, American Locomotive Co.; Pittsburg & Lake Erie, 40, American Locomotive Co.

LAKE SUPERIOR IRON MINES.

There will be much activity on the ranges throughout the winter. All the underground mines will be worked. There will also be a large amount of stripping.

The Eureka mine at Ramsey, the lease of which is held by Corrigan, McKinney & Co., will resume operations shortly. The property adjoins the Anvil mine on the east, and has been idle for six years. One shaft will be opened, and as soon as machinery can be installed the old workings will be pumped out.

The Oliver Iron Mining Co. will erect a large crushing plant at Escanaba near No. 5 ore dock.

Ferdinand Schlesinger in speaking of the probable output of ore for 1903 said a few days ago; "I cannot see that it will exceed this year's much, if any. I have seen an article going the rounds that there will be a 25 percent increase, but this statement is preposterous. If it were possible to secure adequate transportation facilities, such an increase might be probable or possible, but these facilities don't exist. Because of a lack of transportation ore has been taken to lower lake docks and dumped into piles, there being no cars to carry it to the furnaces. This entails a large additional expense, so large, in fact, that ore will not again be shipped when it is probable that it cannot be transported from the docks to the furnaces immediately. With proper facilities there would undoubtedly be a large increase over the present year's output, but the condition of the railroads of the country makes any claim for increase unwarranted. It is possible that transportation affairs will be so straightened out that an increase will be possible. Under this condition I cannot see how it would exceed 4,500,000 tons at the largest estimate. Mining, like everything else just now, is exceedingly prosperous, a fact which is evidenced by the building of 32 new furnaces this year."

The Oliver Iron Mining Co., owner of the Hartford mine at Teal Lake, Mich., is putting in a shaft house of superior construction. The work is being put up by the American Bridge Co., and will stand 126 feet above the abutments, which are of cement, with heavy abutments for bracing on the engine house side.

Richard Cullen, of Duluth, president of the Cullen Iron & Mfg. Co., capitalized at $5,000,000, has made a statement concerning the company. He says that the company controls leases, and owns in fee to a considerable extent, more than 4,000 acres of land in the iron bearing district on the Vermilion and Mesabi ranges. He says that it is the purpose to build furnaces in Chicago after having shown up a sufficient quantity to warrant such a step.

From the town of Eveleth, Minn., 3,705,860 tons of ore was shipped this season, the Fayal leading with 1,919,361 tons and the Adams and Spruce having a total of 1,786,499 tons.

The Commodore will soon be among the operating mines of the Mesabi range. The mine is one of the wettest propositions on the range being surpassed only by the Penobscot at Hibbing. When started up again it will be fully equipped with pumps to keep the mine free from water. The old No. 3 shaft, which has been abandoned for several years, will be reclaimed and many other changes are being planned.

The Lucy mine at Negaunee, recently purchased by the Cleveland-Cliffs Iron Co., will be put in operation after being idle since 1898. Men are now preparing to put the pumps to work and removing the debris.

The big new shaft at the Chapin mine, Menominee range, will be located in the foot wall about 500 feet west of the Ludington shaft, and the work of sinking will commence within two weeks. It is proposed to sink the shaft to a depth of 1,165 feet before any cross-cutting is done. The new shaft will be the most modern in the Lake Superior region, as well as the largest, and will be provided with labor saving and life saving devices. The size of the shaft, inside measurements, will be 10 feet 4 inches by 23 feet 1 inch and will contain four compartments, viz.: Two hoisting compartments 5x8 feet in size, one cageway 5x10 feet 4 inches, and pump compartment 10 feet 4 inches by 11 feet 1 inch.

The contract for stripping the Riverton mine at Stambaugh, Mich., has been let to Jay W. Hoose and Martin King, of Iron Mountain, and work will commence at once. There are 35,000 yards of earth to be removed.

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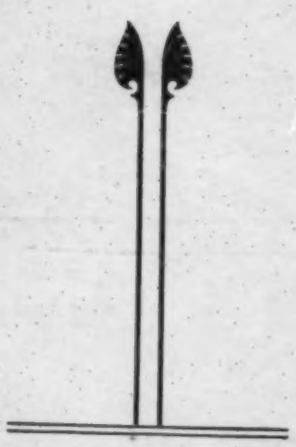

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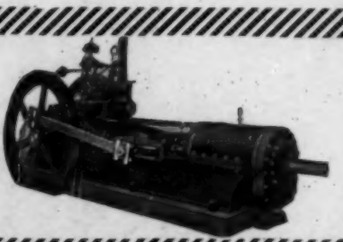

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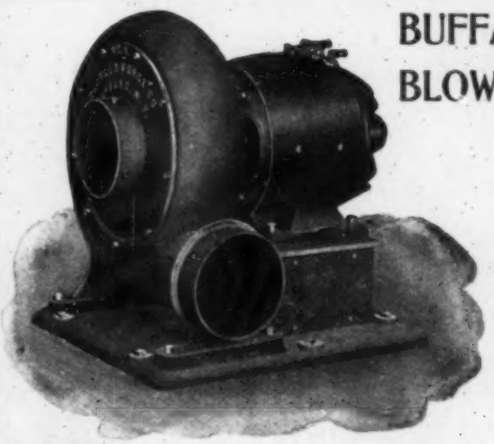

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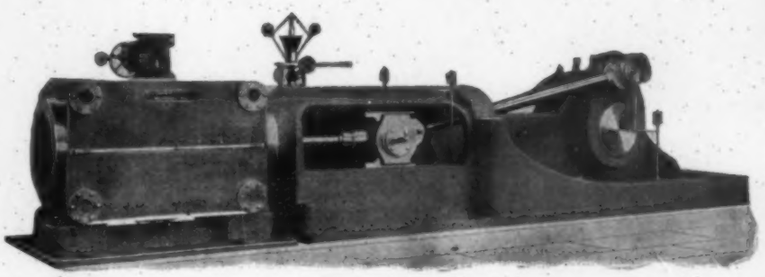

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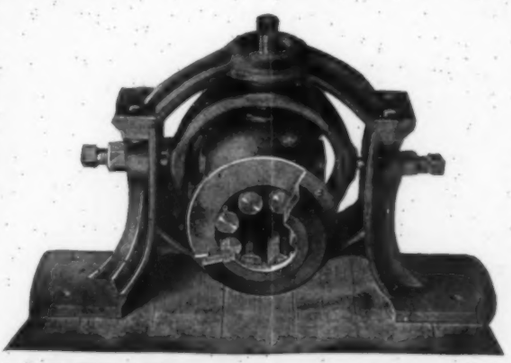

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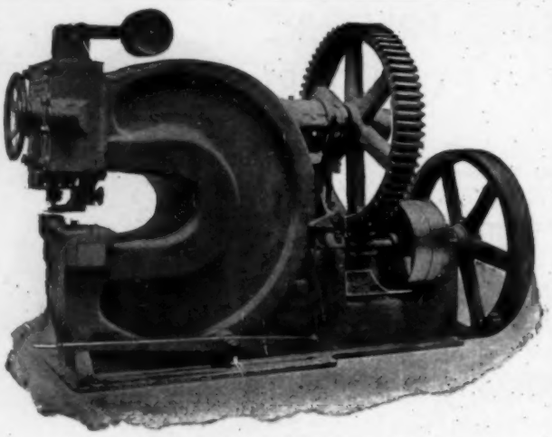

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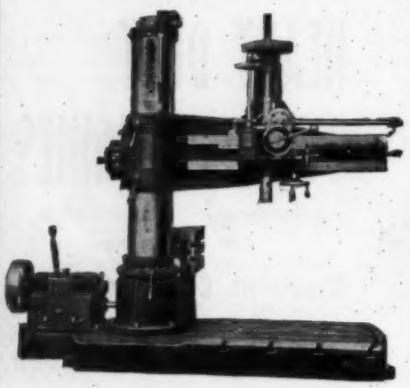

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IS PROVIDED WITH A DEPTH GAUGE which enables operator to read all depths from zero, thereby avoiding the liability of error incident to reading a given distance from a fraction.

IS EQUIPPED WITH AN AUTOMATIC TRIP which operates at different depths, thus making it useful for all repetition work, whether requiring one or a dozen operations to complete.

THESE ARE BUT TWO of the "56 Points of Vantage" embodied in our Drill.

Send for booklet, "56 POINTS OF VANTAGE."

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NEW **IN STOCK**

Detrick & Harvey Planer with two heads on cross rail and one side head, 36 in. x 36 in. x 12 ft.

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No. 4 Brown & Sharpe Universal Milling Machine.

One 6-ft. Fosdick Machine Tool Co. Full Universal Radial Drill.

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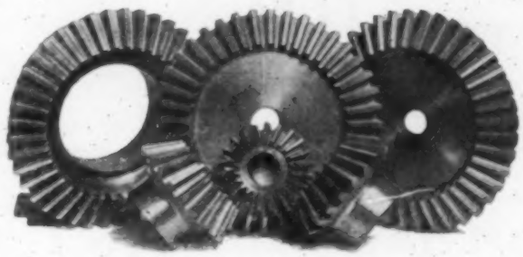

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by curtailing power expenses and adding to the efficiency of a machine—Nuttall Gears are mechanically and practically perfect always, and go to you guaranteed.

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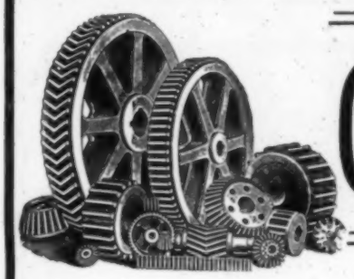

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Conveyors,
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Use any kind of gears he wants to, you can afford to use only the best if you intend to have a reputation for your machines. Those who use them say the Van Dorn & Dutton gears are accurate and the only gears it pays to put on a machine.

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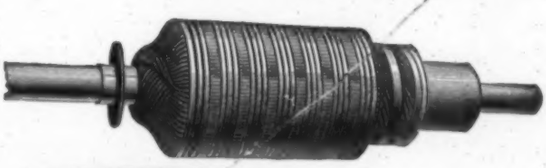

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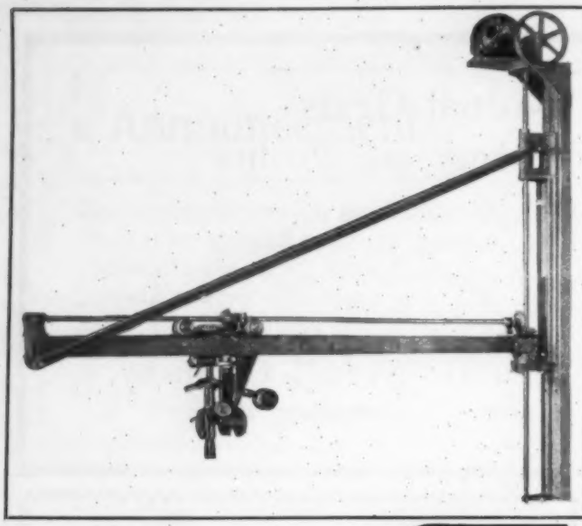

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with automatic feed, including hand wheel and lever feed, equipped with power raising and lowering attachment. Lengths of arm 6 ft. to 16 ft.

Write for capacity and price.

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Matchless

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Drop-Forgings only

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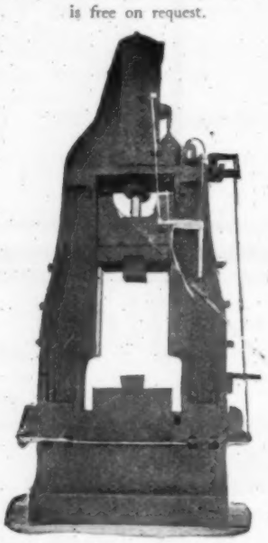
to buy a good Steam Hammer, but is it? Are thoroughly good Steam Hammers so common that you can safely buy the first hammer that is brought to your attention? We think not. We have been designing and building Steam Hammers for twenty years, and we know that there is as great a difference in Steam Hammers as in anything else. We believe that ours are surely better than others, in every way, but we do not ask you to buy them without investigating others, because we believe such investigations will make you all the more willing to buy ours, and all the better satisfied with them after you have bought them.

OUR ILLUSTRATED CATALOGUE is free on request.



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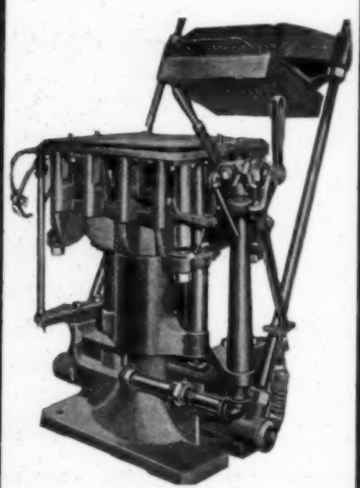
can longer afford to mold—valves—brake shoes—journal bearings—car castings—agricultural machine parts—



hardware—radiators—grate bars, etc., etc., without a

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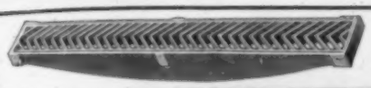

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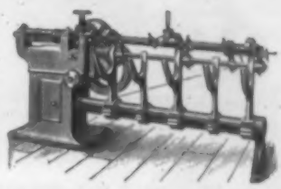

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If your work requires riveting a number of rivets, or drilling a number of holes, you should send for our Booklet telling of the special labor-saving machines we make.

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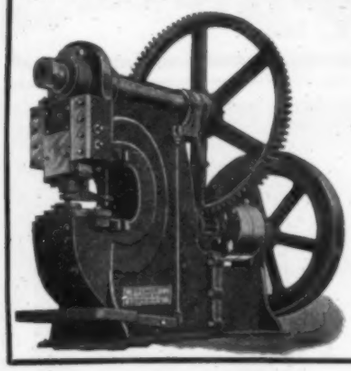

Will show you what we make, and you will learn from it that our tools are up-to-date in every way — strong, serviceable and durable.

This is borne out by use of the tools, and "once a user, always a praiser" is true of all who have bought and used our tools.

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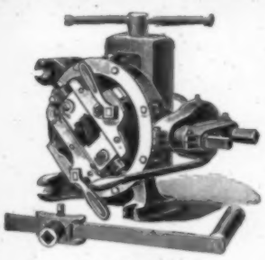

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Can interfere with the work of
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Moving parts run in oil in covered chambers.
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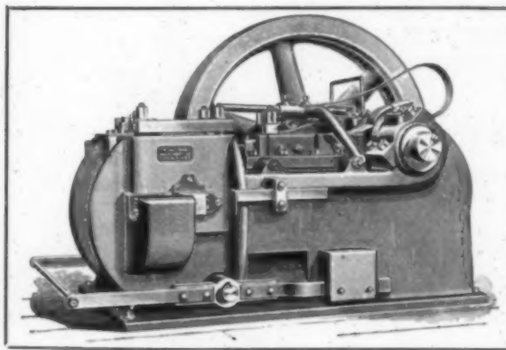

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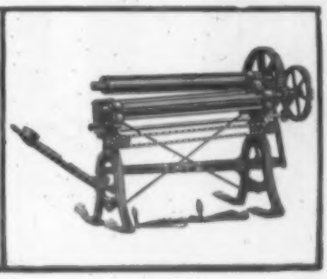

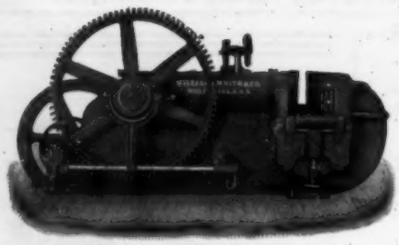

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are just the thing to introduce into your plant to increase production; can be put in working order within an hour after they are unpacked. Improvement of this kind does not delay your work and begins to show results immediately. You cannot afford to do hoisting by hand these busy times.

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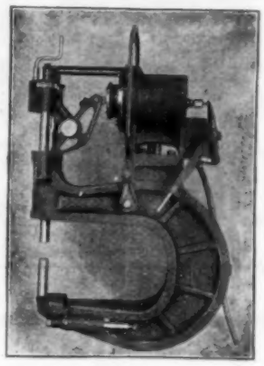

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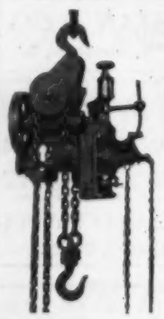

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Range 2¼-6 in. R. H.

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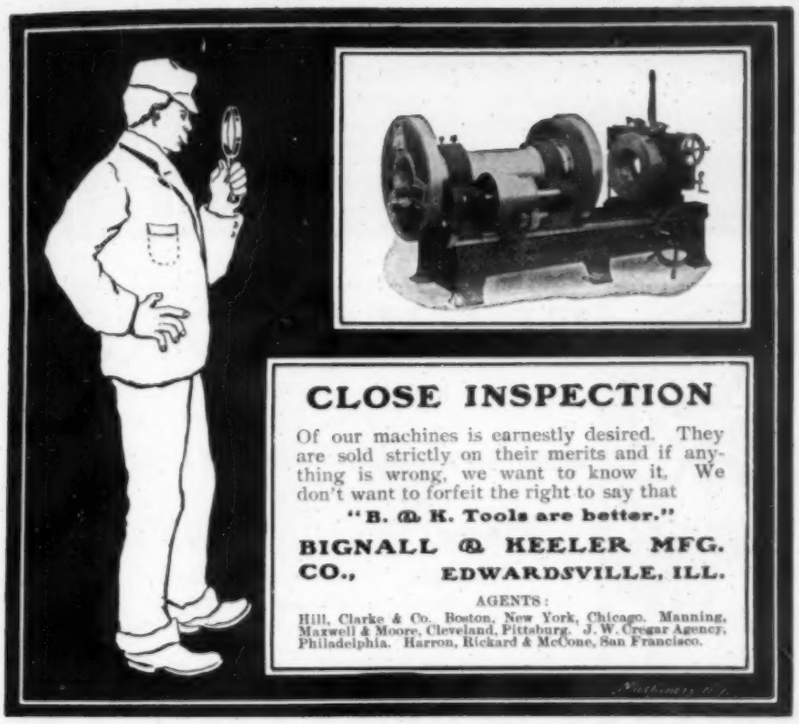

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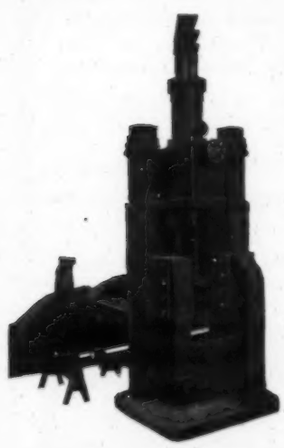

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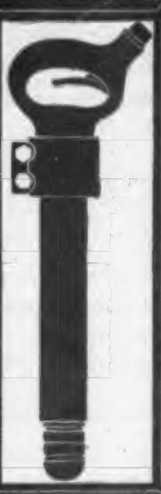

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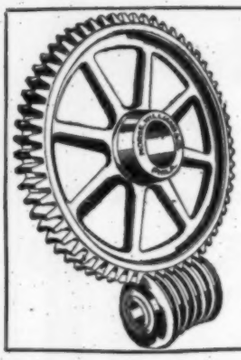

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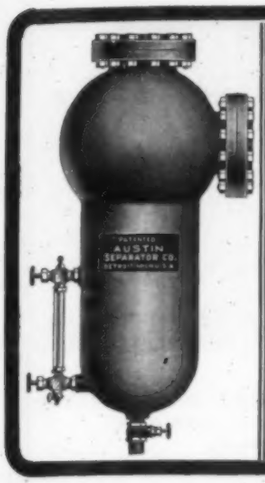

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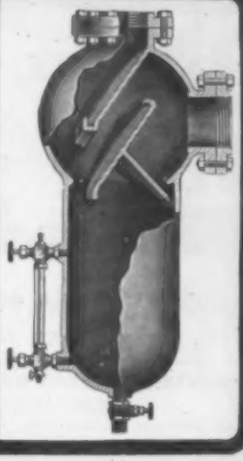

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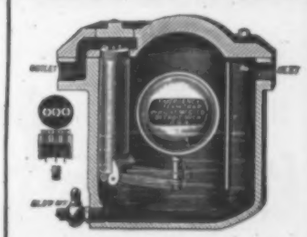

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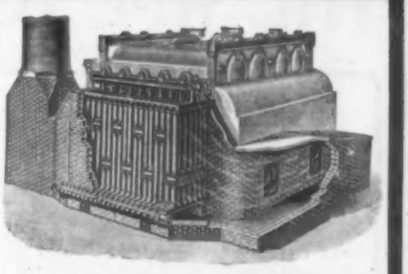

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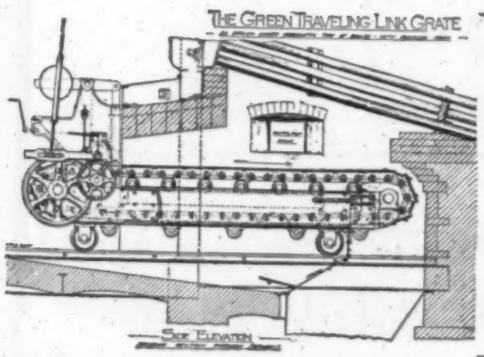

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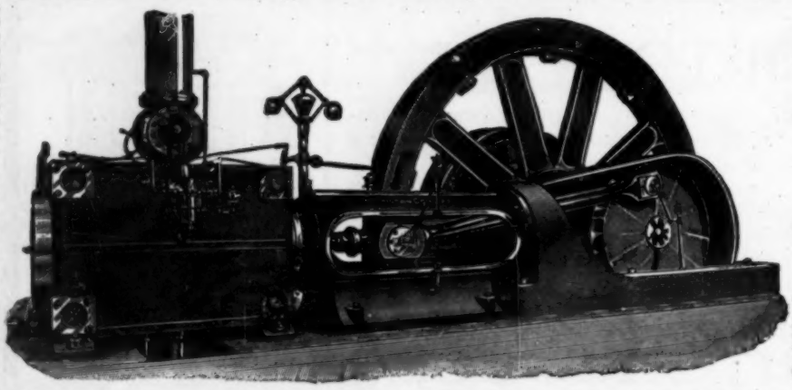

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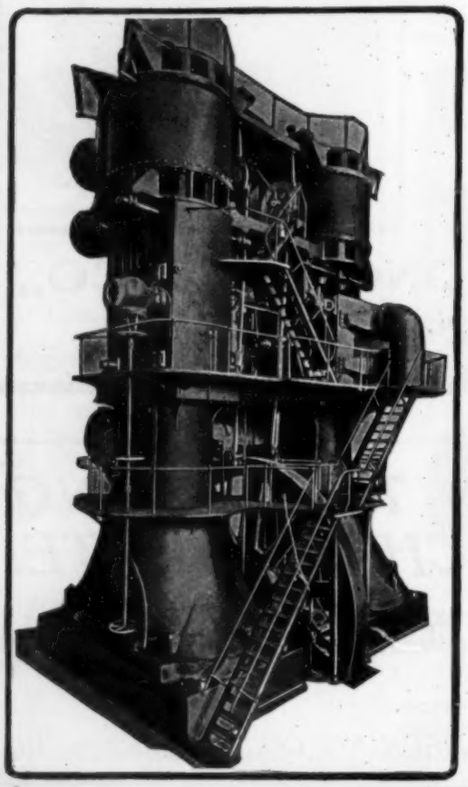

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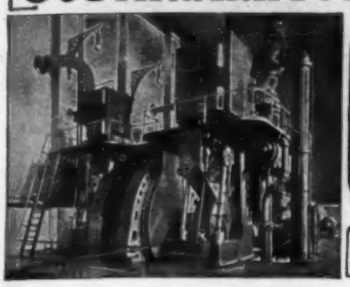

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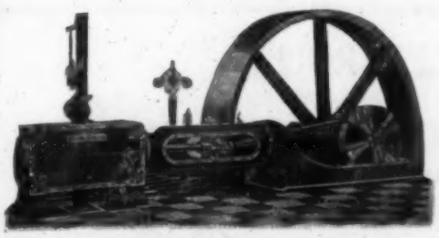

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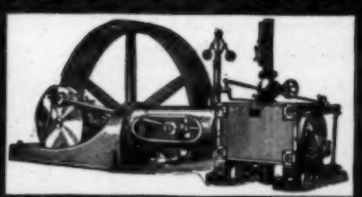

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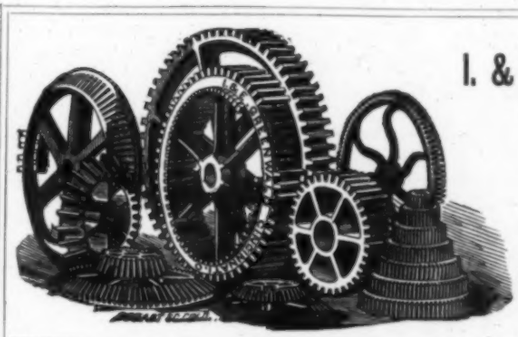

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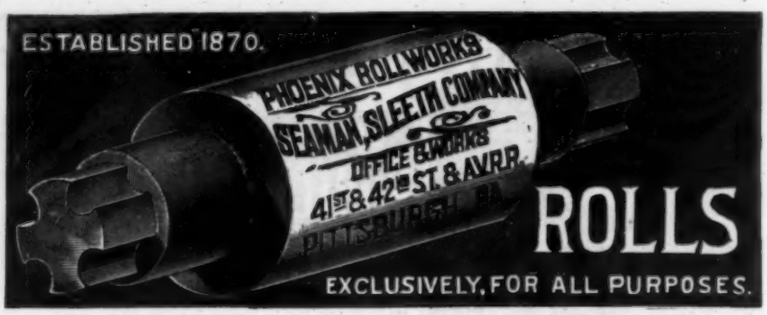

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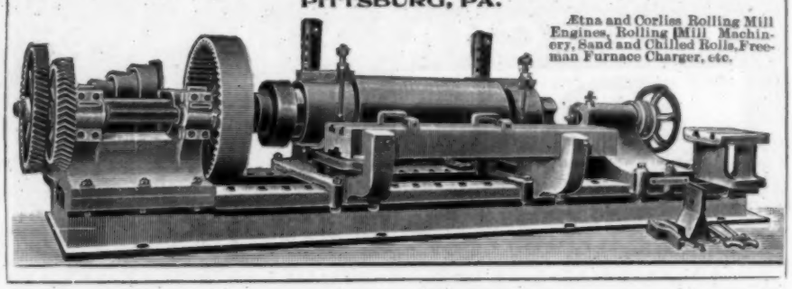

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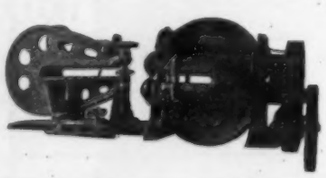

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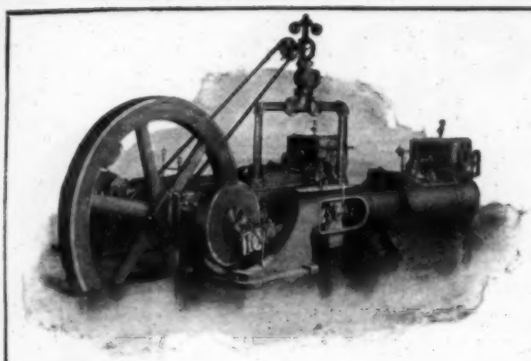

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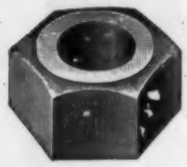

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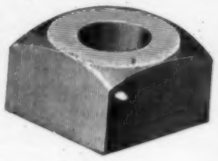

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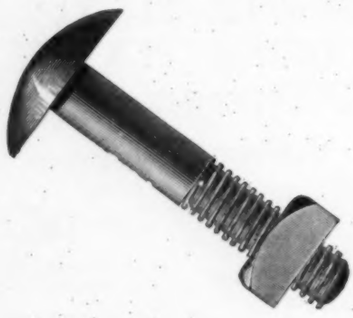

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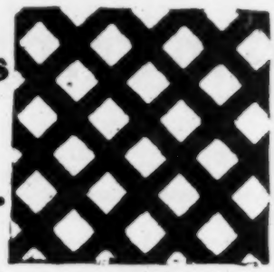
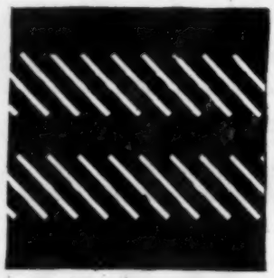
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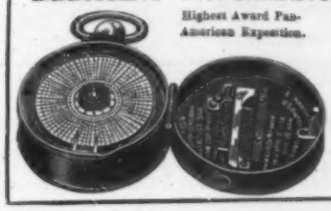

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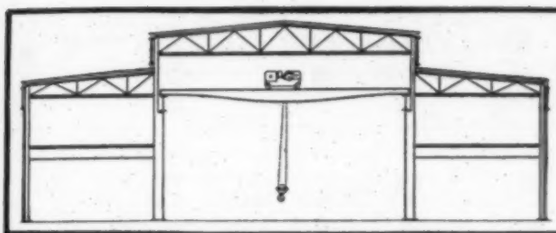

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Pipe Machine, Armstrong.
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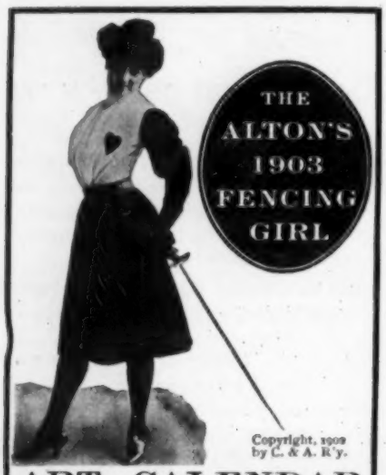

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Mechanical Index

AND

Buyers' directory of articles advertised, classified for handy reference under the following division headings:

DIVISION I—MACHINE TOOLS AND ACCESSORIES—Machine tools and parts, fixtures, mechanics' small tools, etc.

DIVISION II—GENERAL MACHINERY—All classes of machinery, such as punching, shearing, rolling mill, mining, pumping, electrical, hoisting and conveying machinery, etc.

DIVISION III—FOUNDRY EQUIPMENT AND SUPPLIES—Equipment, appliances and supplies for foundry and pattern shop.

DIVISION IV—POWER PLANT EQUIPMENT—Steam and power transmission appliances, etc.

DIVISION V—IRON AND STEEL—Iron and steel of all kinds and shapes, castings, forgings, pig iron, tin and terne, nails, wire, screws, bolts washers, etc.

DIVISION VI—MISCELLANEOUS EQUIPMENT AND SUPPLIES.

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ARBOR PRESSES—
W. F. & John Barnes Co., Rockford, Ill.
Edwin E. Bartlett, Boston, Mass.

BORING AND TURNING MILLS—
Baird Machinery Co., Pittsburg, Pa.
Bement, Miles & Co., Philadelphia, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Espen-Lucas Mach. Wks., Philadelphia, Pa.
Franklin Machine Works, Philadelphia, Pa.
Hill, Clarke & Co., Chicago, Ill.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Keystone Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York City.
Pond Machine Tool Co., New York City.

BORING AND DRILLING MACHINES (Horizontal)—
Bement, Miles & Co., Philadelphia, Pa.
Binsse Machine Co., Newark, N. J.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Franklin Mach. Wks., Phila., Pa.
Keystone Machine Tool Works, Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Chas. G. Smith Co., Pittsburg, Pa.

CALIPERS—
E. G. Smith, Columbia, Pa.

CENTERS, (Planer)—
Fay & Scott, Dexter, Me.
Pratt & Whitney Co., Hartford, Conn.

CENTERING MACHINES—
Pratt & Whitney Co., Hartford, Conn.

CHUCKS (Drill)—
Francis Reed Co., Worcester, Mass.

CHUCKS, (Lathe)—
Pratt & Whitney Co., Hartford, Conn.

CHUCKS (Planer)—
Francis Reed Co., Worcester, Mass.

CUTTERS (Gear)—
Brown & Sharpe Mfg. Co., Providence, R. I.

CUTTERS (Milling)—
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharp Mfg. Co., Providence, R. I.

CUTTING OFF MACHINES (Cold Metal)—
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Espen-Lucas Mach. Wks., Philadelphia, Pa.
Franklin Machine Wks., Philadelphia, Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Keystone Machine Tool Wks., Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
O. & C. Co., Chicago, Ill.
Reade Machy. Co., Cleveland, O.
J. R. Vandyck Co., New York City.

CUTTING OFF TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

DIES (Self-opening)—
W. W. & C. F. Tucker, Hartford, Conn.

DRILLING MACHINES (Bench)—
Baird Machy. Co., Pittsburg, Pa.
W. F. & John Barnes Co., Rockford, Ill.
Chapin-Love Machine Co., New York City.
Wm. Gardam & Son, New York City.
Hill, Clark & Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.

DRILLING MACHINES (Horizontal)—
W. F. & John Barnes Co., Rockford, Ill.

DRILLING MACHINES (Multiple Spindle)—
W. F. & John Barnes Co., Rockford, Ill.
H. G. Barr, Worcester, Mass.
Baird Machy. Co., Pittsburg, Pa.
Bement, Miles & Co., Philadelphia, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Chapin-Love Machine Co., New York City.
Cleveland Punch & Shear Works Co., Cleveland, O.
Fenn-Sadler Mach. Co., Hartford, Conn.
Wm. Gardam & Son, New York City.
Hill, Clarke & Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Pratt & Whitney Co., Hartford, Conn.
Francis Reed Co., Worcester, Mass.
Chas. G. Smith Co., Pittsburg, Pa.

DRILLING MACHINES (Pneumatic)—
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
O. & C. Co., Chicago, Ill.

DRILLING MACHINES (Radial)—
Bement, Miles & Co., Philadelphia, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt., Prentiss Tool & Supply Co., Pittsburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Hill, Clarke & Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Pond Machine Tool Co., New York City.
Reade Machy. Co., Cleveland, O.
Chas. G. Smith Co., Pittsburg, Pa.

DRILLING MACHINES (Sensitive)—
W. F. & John Barnes Co., Rockford, Ill.
H. G. Barr, Worcester, Mass.
Chapin-Love Mach. Co., New York City.
Fenn-Sadler Mach. Co., Hartford, Conn.
Wm. Gardam & Son, New York City.
Hill, Clarke & Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Norton & Jones Mach. Tool Wks., Plainville, Conn
Francis Reed Co., Worcester, Mass.

DRILLING MACHINES (Turret)—
Wm. Gardam & Son, New York City.
Niles Tool Works Co., New York City.

DRILLING MACHINES (Upright)—
W. F. & John Barnes Co., Rockford, Ill.
H. G. Barr, Worcester, Mass.
Baird Machinery Co., Pittsburg, Pa.
Baker Bros., Toledo, O.
Bement, Miles & Co., Philadelphia, Pa.
J. E. Bissell, Agt., Prentiss Tool & Supply Co., Pittsburg, Pa.
Chapin-Love Machine Co., New York City.
Wm. Gardam & Son, New York City.
Hill, Clarke & Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reade Machy. Co., Cleveland, O.
Francis Reed Co., Worcester, Mass.

EMERY—
See Grinding Wheels, Division I.

EMERY WHEEL DRESSERS—
J. Wendell Cole, Columbus, O.
Norton Emery Wheel Co., Worcester, Mass.
The Tanite Co., Stroudsburg, Pa.

FLEXIBLE SHAFTS—
Stow Mfg. Co., Binghamton, N. Y.

GEARING—
The Allis-Chalmers Co., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Gear & Pattern Works, Buffalo, N. Y.
F. H. Bultman & Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago, Ill.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Farrel Fdy. & Machine Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburg, Pa.
Filer & Stowell Co., Milwaukee, Wis.
Wm. Ganschow, Chicago, Ill.
Great Lakes Engineering Works, Detroit, Mich.
I. & E. Greenwald Co., Cincinnati, O.
James & Foote, Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.
Ferd. Messmer Mfg. Co., St. Louis, Mo.
Mesta Machine Co., Pittsburg, Pa.
Morse, Williams & Co., Philadelphia, Pa.
National Gear Wheel & Fdy. Co., Allegheny, Pa.
New Process Rawhide Co., Syracuse, N. Y.
R. D. Nuttall Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
H. G. Turley, St. Louis, Mo.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR CUTTING MACHINES—
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
F. H. Bultman & Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

GEARS (CUT)—
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Gear & Pattern Works, Buffalo, N. Y.
F. H. Bultman & Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago.
Farrel Fdy. & Machine Co., Ansonia, Conn.
Wm. Ganschow, Chicago, Ill.
Morse, Williams & Co., Philadelphia, Pa.
R. D. Nuttall Co., Pittsburg, Pa.
H. G. Turley, St. Louis, Mo.
The VanDorn & Dutton Co., Cleveland, O.

GEARS (RAWHIDE)—
Chicago Rawhide Mfg. Co., Chicago, Ill.
New Process Rawhide Co., Syracuse, N. Y.
R. D. Nuttall Co., Pittsburg, Pa.

GEARS (WORM)—
Brown & Sharpe Mfg. Co., Providence, R. I.
Morse, Williams & Co., Philadelphia, Pa.
R. D. Nuttall Co., Pittsburg, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GRINDERS (CENTRE)—
Hill, Clarke & Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
R. M. Russell, Binghamton, N. Y.
Stow Mfg. Co., Binghamton, N. Y.

GRINDERS (CUTTER)—
Automatic Machine Co., Greenfield, Mass.
H. G. Barr, Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Norton Emery Wheel Co., Worcester, Mass.
R. M. Russell, Binghamton, N. Y.

GRINDERS (DISC.)—
Automatic Machine Co., Greenfield, Mass.
Bayldon Mach. & Tool Co., Jersey City, N. Y.
Iroquois Machine Co., New York City.

GRINDERS (DRILL)—
J. Wendell Cole, Columbus, O.
Hill, Clarke & Co., Chicago, Ill.
Chas. G. Smith Co., Pittsburg, Pa.

GRINDERS (SAW)—
Espen-Lucas Mach. Wks., Philadelphia, Pa.
Keystone Machine Tool Works, Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
O. & C. Co., Chicago, Ill.
The Tanite Co., Stroudsburg, Pa.
J. R. Vandyck Co., New York City.

GRINDERS (SURFACE)—
Iroquois Machine Co., New York City.
The Tanite Co., Stroudsburg, Pa.
John Van Benschoten, Poughkeepsie, N. Y.

GRINDERS (TOOL)—
J. Wendell Cole, Columbus, O.
Iroquois Mach. Co., New York City.
Norton Emery Wheel Co., Worcester, Mass.
The Tanite Co., Stroudsburg, Pa.
Tucker Machine Co., Cincinnati, O.

GRINDERS (UNIVERSAL)—
H. G. Barr, Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hill, Clarke & Co., Chicago, Ill.
Iroquois Mach. Co., New York City.
Norton Emery Wheel Co., Worcester, Mass.

GRINDING MACHINES—
Automatic Machine Co., Greenfield, Mass.
W. F. & John Barnes Co., Rockford, Ill.
Bayldon Mach. & Tool Co., Jersey City, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
J. Wendell Cole, Columbus, O.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill, Clarke & Co., Chicago, Ill.
Iroquois Machine Co., N. Y. City.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
R. M. Russell, Binghamton, N. Y.
Chas. G. Smith Co., Pittsburg, Pa.
The Tanite Co., Stroudsburg, Pa.
Tucker Machine Co., Cincinnati, O.
John Van Benschoten, Poughkeepsie, N. Y.

GRINDING WHEELS—
Carborundum Co., Niagara Falls, N. Y.
J. Wendell Cole, Columbus, O.
Norton Emery Wheel Co., Worcester, Mass.
Chas. G. Smith Co., Pittsburg, Pa.

HACK SAWS—
O. & C. Co., Chicago, Ill.

KEYSEATERS—
Baker Bros., Toledo, O.
John T. Burr & Son, Brooklyn, N. Y.

LATHES—
Automatic Machine Co., Greenfield, Mass.
Baird Machy. Co., Pittsburg, Pa.
W. F. & John Barnes Co., Rockford, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Joseph E. Bissell, Agt., Prentiss Tool & Supply Co., Pittsburg, Pa.
Fay & Scott, Dexter, Me.
Fenn-Sadler Mach. Co., Hartford, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill, Clarke & Co., Chicago, Ill.
E. E. Johnson, Worcester, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
R. E. Kidder, Worcester, Mass.
Niles Tool Works Co., New York City.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
P. P. Silk Mach. Co., Cincinnati, O.
Chas. G. Smith Co., Pittsburg, Pa.

LATHES (BENCH)—
Automatic Mach. Co., Greenfield, Mass.
Fay & Scott, Dexter, Me.
Fenn-Sadler Mach. Co., Hartford, Conn.
E. E. Johnson, Worcester, Mass.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y

LATHES (BUFFING)—
The Tanite Co., Stroudsburg, Pa.
Tucker Machine Co., Cincinnati, O.

LATHES (FOOT)—
Automatic Machine Co., Greenfield, Mass.
W. F. & John Barnes Co., Rockford, Ill.
Fenn-Sadler Mach. Co., Hartford, Conn.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

LATHES (PATTERN MAKERS)—
Fay & Scott, Dexter, Maine.

LATHE ATTACHMENTS—
Bayldon Mach. & Tool Co., Jersey City, N. J.
Fay & Scott, Dexter, Me.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

LATHE DOGS—
Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Hill Tool Co., Anderson, Ind.
Pratt & Whitney Co., Hartford, Conn.
J. H. Wililams & Co., Brooklyn, N. Y.

LATHE TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

LEVELS—
E. G. Smith, Columbia, Pa.

MACHINE SCREWS—
Brown & Sharp Mfg. Co., Providence, R. I.

MACHINE TOOLS—
Acme Machinery Co., Cileveland, O.
Sidney E. Adams, Buffalo, N. Y.
Alliance Machine Co., Alliance, O.
American Machine Co., Cleveland, O.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Automatic Machine Co., Greenfield, Mass.
Avery Stamping Co., Cleveland, O.
Baird Machy. Co., Pittsburg, Pa.
Baker Bros., Toledo, O.
W. F. & John Barnes Co., Rockford, Ill.
H. G. Barr, Worcester, Mass.
Edwin E. Bartlett, Boston, Mass.
Bayldon Mach. & Tool Co., Jersey City, N. J.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Binsse Machine Co., Newark, N. J.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
Bremer Machine & Tool Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
F. H. Bultman & Co., Cleveland, O.
John T. Burr & Son, Brooklyn, N. Y.
Chapin-Love Machine Co., New York City.
Cincinnati Shaper Co., Cincinnati, O.
The Cleveland Punch & Shear Works Co., Cleveland, O.
Curtis & Curtis Co., Bridgeport, Conn.
Espen-Lucas Mach. Wks., Philadelphia, Pa.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fay & Scott, Dexter, Me.
Fenn-Sadler Mach. Co., Hartford, Conn.
Franklin Machine Works, Philadelphia, Pa.
Wm. Gardam & Son, New York City.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill, Clarke & Co., Chicago, Ill.
Hilles & Jones Co., Wilmington, Del.
Hill Tool Co., Anderson, Ind.
Hurlbut-Rogers Machine Co., South Sudbury, Mass.
Ideal Machine Co., Hartford, Conn.
Iroquois Machine Co., New York City.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Keystone Machine Tool Works, Philadelphia, Pa.
R. E. Kidder, Worcester, Mass.
Merrell Mfg. Co., Toledo, O.
Modern Tool Co., Erie, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
National Machinery Co., Tiffin, O.
Niles-Bement-Pond Co., New York City.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Nutter, Barnes & Co., Boston, Mass.
Reade Machinery Co., Cleveland, O.
Francis Reed Co., Worcester, Mass.
R. M. Russell, Binghamton, N. Y.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
F. B. Shuster Co., New Haven, Conn.
P. P. Silk Mach. Co., Cincinnati, O.
Chas. G. Smith Co., Pittsburg, Pa.
Special Machinery Co., Bridgeport, Conn.
The Tanite Co., Stroudsburg, Pa.
Tucker Machine Co., Cincinnati, O.
John Van Benschoten, Poughkeepsie, N. Y.
Watson-Stillman Co., New York City
Western Tool Co., Lansing, Mich.
Williams Tool Co., Erie, Pa.
Williams, White & Co., Moline, Ill.

MACHINE TOOL HANDLES—
Norwood Mach. & Mfg. Co., Cincinnati, O.

MILLING MACHINES (BENCH)—
Baird Machy. Co., Pittsburg, Pa.
Hill, Clark & Co., Chicago, Ill.

MILLING MACHINES (HORIZONTAL)—
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bement, Miles & Co., Philadelphia, Pa.
Franklin Mach. Works, Philadelphia, Pa.
Keystone Machine Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.

MILLING MACHINES (PLAIN)—
Baird Machy. Co., Pittsburg, Pa.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Franklin Machine Works, Philadelphia, Pa.
Hill, Clarke & Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Chas. G. Smith Co., Pittsburg, Pa.

MILLING MACHINES (VERTICAL)—
Baird Machy. Co., Pittsburg, Pa.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Franklin Machine Works, Philadelphia, Pa.
Hill, Clarke & &Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Chas. G. Smith Co., Pittsburg, Pa.
Dodge Mfg. Co., Mishawaka, Ind.
Francis Reed Co., Worcester, Mass.

MILLING MACHINE ATTACHMENTS—
Brown & Sharpe Mfg. Co., Providence, R. I.
Geometric Drill Co., Westville, Conn.
Ideal Machine Co., Hartford, Conn.

PLANERS—
Baird Machy. Co., Pittsburg, Pa.
E. E. Bartlett, Boston, Mass.
Bement, Miles & Co., Philadelphia, Pa.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Cincinnati, O.
Hill, Clarke & Co., Chicago, Ill.
Keystone Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York City.
Pond Machine Tool Co., New York City.
Chas. G. Smith Co., Pittsburg, Pa.

PLANERS (ROTARY)—
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Franklin Machine Wks., Philadelphia, Pa.
Keystone Machine Tool Works, Philadelphia, Pa.
Pond Machine Tool Co., New York City.

PULLEY TURNING & BORING MACHINES—
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Niles Tool Wks. Co., New York City.

RACKS (MACHINE CUT)—
R. D. Nuttall Co., Pittsburg, Pa.

REAMERS—
Pratt & Whitney Co., Hartford, Conn.
Western Tool Co., Lansing, Mich.

SAWING OFF MACHINES (METAL)—
See Cutting Off Machines, Division I.

SCREW MACHINES (AUTOMATIC)—
Automatic Mach. Co., Greenfield, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Pratt & Whitney Co., Hartford, Conn.

SCREW MACHINES (HAND)—
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

SECOND-HAND MACHINERY—
Sidney E. Adams, Buffalo, N. Y.
Baird Machy. Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
The Bosworth-Holding Co., Cleveland, O.
Jacob Cohen, Jacksonville, Ill.
Dravo, Doyle & Co., Pittsburg, Pa.
Hyde Bros. & Co., Pittsburg, Pa.
Edgar S. Low Co., Pittsburg, Pa.
Reade Machinery Co., Cleveland, O.
Wickes Bros., Pittsburg, Pa.
Wickes Bros., Saginaw, Mich.
C. C. Wormer Machinery Co., Detroit, Mich.

SHAPERS—
Bement, Miles & Co., Philadelphia, Pa.
Cincinnati Shaper Co., Cincinnati, O.
Hill, Clarke & Co., Chicago, Ill.
Chas. G. Smith Co., Pittsburg, Pa.

SLOTTERS—
Baker Bros., Toledo, O.
Bement, Miles & Co., Philadelphia, Pa.
Franklin Mach. Wks., Philadelphia, Pa.
Niles Tool Works Co., New York City.

STOCKS AND DIES—
Armstrong Mfg. Co., Bridgeport, Conn.
Curtis & Curtis Co., Bridgeport, Conn.
Geometric Drill Co., Westville, Conn.
W. W. & C. F. Tucker, Hartford, Conn.

TAPS AND DIES—
Geometric Drill Co., Westville, Conn.
Western Tool Co., Lansing, Mich.

TAPPING MACHINES (NUT)—
Acme Machinery Co., Cleveland, O.
Baker Bros., Toledo, O.
National Machinery Co., Tiffin, O.
Francis Reed Co., Worcester, Mass.
Williams Tool Co., Erie, Pa.

TAPPING MACHINES AND ATTACHMENTS—
Baker Bros., Toledo, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

THREAD CUTTING TOOLS—
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Pratt & Whitney Co., Hartford, Conn.
Williams Tool Co., Erie, Pa.

TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.

TOOL POSTS (INTERCHANGEABLE)—
Bayldon Mach. & Tool Co., Jersey City, N. J.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Norwood Mach. & Mfg. Co., Cincinnati, O.

TURRET MACHINES—
Automatic Mach. Co., Greenfield, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fay, Scott & Co., Dexter, Me.
Geometric Drill Co., Westville, Conn.
Hill, Clarke & Co., Chicago, Ill.
Jones & Lamson Mach. Co., Springfield, Vt.
Niles Tool Works Co., New York City.
Pratt & Whitney Co., Hartford, Conn.

TURRETS (CARRIAGE)—
Fay & Scott, Dexter, Me.

TWIST DRILLS—
Western Tool Co., Lansing, Mich.

VISES—
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Emmert Mfg. Co., Waynesboro, Pa.
Graham Mfg. Co., Providence, R. I.
Merrill Bros., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

WRENCHES (MACHINISTS)—
Billings & Spencer Co., Hartford, Conn.

DIVISION II

General Machinery

ACCUMULATORS—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Chambersburg Engineering Co., Chambersburg, Pa.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

AIR COMPRESSORS—
The Allis-Chalmers Co., Chicago, Ill.
American Air Compressor Works, N. Y. City.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.
N. A. Christensen, Milwaukee, Wis.
The Filer & Stowell Co., Milwaukee, Wis.
Havana Bridge Wks, Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York City.
Rand Drill Co., New York City.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

BENDING MACHINES—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
National Machy. Co., Tiffin, O.
Watson-Stillman Co., New York City.
Williams White & Co., Moline, Ill.
R. D. Wood & Co., Philadelphia, Pa.

BOLT AND NUT MACHINERY—
Acme Machinery Co., Cleveland, O.
Baird Machinery Co., Pittsburg, Pa.
National Machinery Co., Tiffin, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams Tool Co., Erie, Pa.

BRIQUETTING MACHINERY—
Henry S. Mould Co., Pittsburg, Pa.

BULLDOZERS—
National Machinery Co., Tiffin, O.
Williams, White & Co., Moline, Ill.

CHAIN MACHINERY—
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CLUTCHES—
Aultman Co., Canton, O.
Brown Hoisting Machy. Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Link Belt Machinery Co., Chicago, Ill.
Chas. G. Smith Co., Pittsburg, Pa.

CLUTCHES (Friction)—
Benedict Mfg. Co., Salamanca, N. Y.

COAL CUTTERS—
Ingersoll Sergeant Drill Co., N. Y. City.
Jeffrey Mfg. Co., Columbus, O.

COMPRESSORS (Air)—
See Air Compressors, Division II.

CONVEYING MACHINERY—
Allis, Chalmers Co., Chicago, Ill.
The Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
The Brown Hoisting Machy. Co., Cleveland, O.
Buhl Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Exeter Machine Works, Pittston, Pa.
Federal Manufacturing Co., Cleveland.
Filer & Stowell Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Arthur Koppel, New York City.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
J. W. Moyer & Co., Philadelphia, Pa.
Robins Conveying Belt Co., New York City.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.
Webster, Camp & Lane Mach. Co., Akron, O.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

CRANES (Electric)—
Alliance Machine Co., Alliance, O.
Brown Hoisting Machy. Co., Cleveland, O.
Cleveland Crane & Car Co., Wickliffe, O.
Havana Bridge Wks, Montour Falls, N. Y.
Morgan Construction Co., Worcester, Mass.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
Youngstown Engineering Co., Youngstown, O.

CRANES (Hydraulic)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.

CRANES (Ire)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Crane & Car Co., Wickliffe, O.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
Havana Bridge Wks, Montour Falls, N. Y.
Industrial Works, Bay City, Mich.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANES (Locomotive)—
Alliance Machine Co., Alliance, O.
Industrial Works, Bay City, Mich.
Northern Engineering Wks., Detroit, Mich.
M. H. Treadwell & Co., New York City.

CRANES (Portable)—
Franklin Portable Crane & Hoist Co., Franklin, Pa.

CRUSHING MACHINERY (Coal and Ore)—
Allis-Chalmers Co., Chicago, Ill.
Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
A. Garrison Foundry Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Mesta Machine Co., Pittsburg, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wm. Yagle & Co., Pittsburg, Pa.

CUTTERS (Bolt)—
Acme Machinery Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Niles Tool Works Co., New York City.

DRAW BENCHES (Wire)—
Iroquois Machine Co., New York City.
Morgan Construction Co., Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
Hugh L. Thompson, Waterbury, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.

DYNAMOS—
See Electrical Machy., Division II.

ELECTRIC CONTROLLERS—
Electric Controller & Supply Co., Cleveland, O.

ELECTRICAL MACHINERY—
Christensen Engineering Co., Milwaukee, Wis.
Elwell-Parker Electric Co., Cleveland, O.
Iron City Engineering Co., Pittsburg, Pa.
Northern Electrical Mfg. Co., Madison, Wis.
Van Dorn-Elliott Electric Co., Cleveland, O.

ELEVATING AND CONVEYING MACHINERY—
See Conveying Machinery, Division II.

FLEXIBLE SHAFTS—
Stow Mfg. Co., Binghamton, N. Y.

FORGING MACHINES—
Acme Machinery Co., Cleveland, O.
Beaudry & Co., Boston, Mass.
Billings & Spencer Co., Hartford, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.
National Machinery Co., Tiffin, O.
Williams, White & Co., Moline, Ill.

HAMMERS (Drop)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Billings & Spencer Co., Hartford, Conn.
Cleveland Punch & Shear Works Co., Cleveland, O.
Iroquois Machine Co., New York City.
Merrill Bros., Brooklyn, N. Y.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams, White & Co., Moline, Ill.

HAMMERS (Pneumatic)—
Cleveland Pneumatic Tool Co., Cleveland, O.
Havana Bridge Wks, Montour Falls, N. Y.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

HAMMERS (Power)—
Beaudry & Co., Boston, Mass.
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
R. E. Kidder, Worcester, Mass.
Merrill Bros., Brooklyn, N. Y.
Niles Tool Works Co., New York City.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Williams, White & Co., Moline, Ill.

HAMMERS (Rotary Riveting)—
F. B. Shuster Co., New Haven, Conn.
Williams, White & Co., Moline, Ill.

HAMMERS (Steam)—
Alliance Machine Co., Alliance, O.
Beaudry & Co., Boston, Mass.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Falkenau-Sinclair Mich. Co., Philadelphia, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.

HOISTING MACHINERY—
The Aultman Co., Canton, O.
Earle C. Bacon, New York City.
The Brown Hoisting Machy. Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago, Ill.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Exeter Machine Works, Pittston, Pa.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
J. W. Moyer & Co., Philadelphia, Pa.
J. S. Mundy, Newark, N. J.
Webster, Camp & Lane Machine Co., Akron, O.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

HOISTS (Air)—
N. A. Christensen, Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Havana Bridge Works, Montour Falls, N. Y.
Northern Engineering Wks., Detroit, Mich.
Q. & C. Co., Chicago, Ill.

HOISTS (Chain)—
Dake Engine Co., Grand Haven, Mich.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Havana Bridge Works, Montour Falls, N. Y.
J. W. Moyer & Co., Philadelphia, Pa.
Niles Tool Works Co., New York City.

HOISTS (Pneumatic)—
Havana Bridge Works, Montour Falls, N. Y.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
Q. & C. Co., Chicago, Ill.
Rand Drill Co., New York City.

MINING MACHINERY—
The Allis-Chalmers Co., Chicago, Ill.
The Atlas Car & Mfg. Co., Cleveland, O.
The Bucyrus Co., South Milwaukee, Wis.
Wm. Cramp & Sons, Philadelphia, Pa.
Dravo, Doyle & Co., Pittsburg, Pa.
Great Lakes Engineering Co., Detroit, Mich.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Thew Automatic Shovel Co., Lorain, O.
M. H. Treadwell & Co., New York City.
Webster, Camp & Lane Co., Akron, O.
Wm. Yagle & Co., Pittsburg, Pa.

ORE HANDLING MACHINERY—
Atlas Car & Mfg. Co., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.
Arthur Koppel, New York City.
Link-Belt Machinery Co., Chicago, Ill.
M. H. Treadwell & Co., New York City.
Webster, Camp & Lane Co., Akron, O.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

PIPE CUTTING AND THREADING MACHINES—
See Thread Cutting Tools, Division I.

PIPE FITTERS—
Central Pipe & Valve Co., Allegheny, Pa.
Pittsburg Valve, Fdry. & Cons. Co., Pittsburg, Pa.

PNEUMATIC TOOLS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Havana Bridge Works, Montour Falls, N. Y.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

POINTING MACHINES (Wire)—
Morgan Construction Co., Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
F. B. Schuster Co., New Haven, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PRESSES (Blanking)—
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Billings & Spencer, Hartford, Conn.
Cleveland Punch & Shear Works Co., Cleveland, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Special Machinery Co., Bridgeport, Conn.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PRESSES (Forging)—
Alliance Machine Co., Alliance, O.
Avery Stamping Co., Cleveland, O.
Beaudry & Co., Boston, Mass.
Bement, Miles & Co., Philadelphia, Pa.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Niles Tool Works Co., New York City.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.

PRESSES (Hydraulic)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Birmingham Iron Foundry, Derby, Conn.
Chambersburg Engineering Co., Chambersburg, Pa.
Farrell Fdy. & Mach. Co., Ansonia, Conn.

Great Lakes Engineering Works, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PRESSES (Power)—
Alliance Machine Co., Alliance, O.
Avery Stamping Co., Cleveland, O.
Beaudry & Co., Boston, Mass.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Niles Tool Works Co., New York City.
F. B. Shuster Co., New Haven, Conn.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PUMPS (Power)—
Allis-Chalmers Co., Chicago, Ill.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PUMPS (Steam)—
The Allis-Chalmers Co., Chicago, Ill.
A. S. Cameron Steam Pump Works, New York.
Dravo, Doyle & Co., Pittsburg, Pa.
The Filer & Stowell Co., Milwaukee, Wis.
Great Lakes Engineering Works, Detroit, Mich.
Ingersoll-Sergeant Drill Co., New York City.
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PUNCHES (Hydraulic)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Chambersburg Engineering Co., Chamberburg, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PUNCHES (Power)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Bignall-Keeler Mfg. Co., Edwardsville, Ill.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Chambersburg Engineering Co., Chamberburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
E. E. Johnson, Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
National Machinery Co., Tiffin, O.
R. S. Newbold & Son Co., Norristown, Pa.
Niles Tool Works Co., New York City.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Reade Machinery Co., Cleveland, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.
R. D. Wood Co., Philadelphia, Pa.

RAIL BENDERS—
Espen-Lucas Mach. Works, Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
O. & C. Co., Chicago, Ill.
Williams, White & Co., Moline, Ill.

RIVETING MACHINES (Hydraulic)—
Alliance Machine Co., Alliance, O.
John F. Allen, New York City.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Havana Bridge Wks., Montour Falls, N. Y.
O. & C. Co., Chicago, Ill.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

RIVETING MACHINES (Pneumatic)—
Jno. F. Allen, New York City.
Bement-Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Havana Bridge Works, Montour Falls, N. Y.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
O. & C. Co., Chicago, Ill.

RIVETING MACHINES (Steam)—
Alliance Machine Co., Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Havana Bridge Wks, Montour Falls, N. Y.

ROCK DRILLS—
Ingersoll-Sergeant Drill Co., New York City.
Rand Drill Co., New York City.

ROLLS (Sand, Chilled and Steel)—
Birmingham Iron Foundry, Derby, Conn.
Farrell Foundry & Mach. Co., Ansonia, Conn.
A. Garrison Foundry Co., Pittsburg, Pa.
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
Mesta Machine Co., Pittsburg, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Seaman Sleeth Co., Pittsburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
West Penn Fdry. & Mach. Co., Avonmore, Pa.
Wheeling Mold & Fdy. Co., Wheeling, W. Va.

ROLLING MILL MACHINERY—
Alliance Machine Co., Alliance, O.
Birmingham Iron Foundry, Derby, Conn.
Farrell Foundry & Mach. Co., Ansonia, Conn.
A. Garrison Foundry Co., Pittsburg, Pa.
Girard Boiler & Mfg. Co., Girard, O.
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
Iroquois Machine Co., New York City.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
R. S. Newbold & Son Co., Norristown, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Geo. B. Sennett Co., Youngstown, O.
Hugh L. Thompson, Waterbury, Conn.
M. H. Treadwell & Co., New York City.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
West Penn Foundry & Machine Co., Avonmore, Pa.
Wheeling Mold & Fdy. Co., Wheeling, W. Va.

SAWING OFF MACHINES (Metal)—
See Cutting Off Machines, Division I.

SHEARS (Alligator)—
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Farrell Foundry & Mach. Co., Ansonia, Conn.
National Machinery Co., Tiffin, O.
Reade Machinery Co., Cleveland, O.
United Engineering & Fdy. Co., Pittsburg, Pa.
Watson-Stillman Co., New York City.

SHEARS (Beam and Channel)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Geo. A. Hogg Iron & Steel Fdy. Co., Pittsburg, Pa.
Reade Machinery Co., Cleveland, O.
United Engineering & Fdy. Co., Pittsburg, Pa.
Watson, Stillman Co., New York City.
Williams, White & Co., Moline, Ill.

SHEARS (Beveling)—
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Niles Tool Works Co., New York City.
Reade Machinery Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

SHEARS (Circular)—
R. S. Newbold & Son Co., Norristown, Pa.

SHEARS (Hydraulic)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Bethlehem Fdy. & Mach. Co., South Bethlehem, Pa.
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
United Engineering & Fdy. Co., Pittsburg, Pa.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

SHEARS (Power)—
E. E. Johnson, Worcester, Mass.

SHEAR KNIVES—
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.

SPECIAL MACHINERY—
Alliance Machine Co., Alliance, O.
American Machine Co., Cleveland, O.
H. G. Barr, Worcester, Mass.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fenn-Sadler Mach. Co., Hartford, Conn.
Wm. Gardam & Son, New York City.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Ideal Machine Co., Hartford, Conn.
R. E. Kidder, Worcester, Mass.
National Machinery Co., Tiffin, O.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Norwood Mach. & Mfg. Co., Cincinnati, O.
Nutter, Barnes & Co., Boston, Mass.
Russell Wheel & Foundry Co., Detroit, Mich.
Special Machinery Co., Bridgeport, Conn.
M. H. Treadwell & Co., New York City.
H. B. Underwood & Co., Philadelphia, Pa.
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams Tool Co., Erie, Pa.
Williams, White & Co., Moline, Ill.

SPIKE MACHINES—
National Machinery Co., Tiffin, O.

STRAIGHTENING MACHINES (Wire)—
F. B. Shuster Co., New Haven, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, N. Y.

STRAIGHTENING MACHINERY (Plate and Beam)—
Bement-Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
R. S. Newbold & Son Co., Norristown, Pa.
Niles Tool Works Co., New York City.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams, White & Co., Moline, Ill.

SWAGING MACHINES—
S. W. Goodyear, Waterbury, Conn.
Iroquois Machine Co., New York City.
Mossberg & Granville Mfg. Co., Providence, R. I.
Special Machinery Co., Bridgeport, Conn.
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.

TAPPING MACHINES—
Acme Machinery Co., Cleveland, O.
Baker Bros., Toledo, O.
National Machinery Co., Tiffin, O.
Niles Tool Works Co., New York City.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stow Mfg. Co., Binghampton, N. Y.

TESTING MACHINES—
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
United Engineering & Fdy. Co., Pittsburg, Pa.

THREAD CUTTING TOOLS—
See Thread Cutting Tools, Division I.

TIN PLATE MACHINERY—
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

TRANSMISSION MACHINERY (Power)—
See Power Transmission Machinery, Division IV.

TRUCKS—
Atlas Car & Mfg. Co., Cleveland, O.
Arthur Koppel, New York City.
Northern Engineering Works, Detroit, Mich.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.

UPSETTING MACHINES—
Acme Machinery Co., Cleveland, O.
National Machinery Co., Tiffin, O.

WIRE WORKING & FORMING MACHINERY—
S. W. Goodyear, Waterbury, Conn.
Iroquois Machine Co., New York City.
Morgan Construction Co., Worcester, Mass.
Mossberg & Granville Mfg. Co., Providence, R. I.
Jos. T. Ryerson & Son, Chicago and New York.
F. B. Shuster Co., New Haven, Conn.
Special Machinery Co., Bridgeport, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.

DIVISION III

Foundry Equipment and Supplies

AIR COMPRESSORS—
See Air Compressors, Division II.

BARROWS (Wheel)—
Akron Cultivator Co., Akron, O.
Atlas Bolt & Screw Co., Cleveland, O.
S. Obermayer Co., Cincinnati, O.
Wm. B. Pollock Co., Youngstown, O.

BELLOWS—
S. Obermayer Co., Cincinnati, O.
J. D. Smith Fdy. Supply Co., Cleeland, O.

BLOWERS—
Buffalo Forge Co., Buffalo, N. Y.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.

BRUSHES—
S. Obermayer Co., Cincinnati, O.

CARS (Foundry)—
Atlas Bolt & Screw Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Arthur Koppel, New York City.
Edgar S. Low Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.

COKE—
See Coal & Coke, Division VI.

CORE COMPOUND—
S. Obemayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdy. Supply Co., Cleveland, O.

CORE OVENS—
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdy. Supply Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.

CRANES—
The Brown Hoisting Machinery Co., Cleveland.
Cleveland Crane & Car Co., Wickliffe, O.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Havana Bridge Works, Montour Falls, N. Y.
The Industrial Works, Bay City, Mich.
Marion Steam Shovel Co., Marion, O.

Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.
Youngstown Engineering Co., Youngstown, O.

CRUCIBLES—
Jos. Dixon Crucible Co., Jersey City, N. J.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdy. Supply, Cleveland, O.

CUPOLAS—
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

EMERY GRINDERS (Portable)—
Norton Emery Wheel Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N. Y.

FACING—
Jos. Dixon Crucible Co., Jersey City, N. J.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdry. Supply Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.

FIRE BRICK AND CLAY—
Geo. G. Blackwell Sons & Co., Liverpool, England.
Clearfield Fire Brick Co., Clearfield, Pa.
Crown Fire Clay Co., Akron, O.
Dover Fire Brick Co., Cleveland, O.
Evens & Howard Fire Brick Co., St. Louis, Mo.
F. B. Holmes & Co., Detroit, Mich.
Kier Fire Brick Co., Pittsburg, Pa.
McFeely-Wheeler Brick Co., Pittsburg, Pa.
Mount Union Silica Brick Co., Pittsburg, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
S. Obermayer Co., Cincinnati, O.
Ohio Fire Brick Co., Oak Hill, O.
J. W. Paxson Co., Philadelphia, Pa.
Portsmouth & Kentucky Fire Brick Co., Portsmouth, O.
Reese-Hammond Fire Brick Co., Bolivar, Pa.
Savage Fire Brick Co., Pittsburg, Pa.
Scioto Fire Brick Co., Sciotoville, O.
J. D. Smith Fdy. Supply Co., Cleveland, O.
Jos. Soisson Fire Brick Co., Connellsville, Pa.
F. B. Stevens, Detroit, Mich.

FLASKS—
S. Obermayer Co., Cincinnati, O.
J. D. Smith Fdy. Supply Co., Cleveland, O.
Wm B. Scaife & Sons Co., Pittsburg, Pa.

FURNACES (Brass Melting)—
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.

FURNACES (Crucible)—
J. A. Herrick, Philadelphia, Pa.
S. Obermayer Co., Cincinnati, O.

GRAPHITE—
Jos. Dixon Crucible Co., Jersey City, N. J.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdy. Supply Co., Cleveland, O.

HAMMERS (Pneumatic Chipping)—
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Q. & C. Co., Chicago, Ill.

HOIST (Electric)—
Cleveland Crane & Car Co., Wickliffe, O.
Lidgerwood Mfg. Co., New York City.
Northern Engineering Works, Detroit, Mich.

HOISTS (Pneumatic)—
Havana Bridge Works, Montour Falls, N. Y.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Rand Drill Co., New York City.

HOISTS (Portable)—
Brown Hoisting Machy. Co., Cleveland, O.
Cleveland Crane-Car Co., Wickliffe, O.
Havana Bridge Works, Montour Falls, N. Y.
J. W. Moyer & Co., Philadelphia, Pa.
Niles Tool Works Co., New York City.
Northern Engineering Wks., Detroit, Mich.

LADLES—
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
M. H. Treadwell & Co., New York City.

MOLDING MACHINES—
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

PATTERN FILLET—
Canton Fillet Co., Canton, O.
S. Obermayer Co., Cincinnati, O.

PATTERN LETTERS—
Cleveland Galvanizing Works, Cleveland, O.
S. Obermayer Co., Cincinnati, O.

PATTERN LUMBER—
Johnson Lumber Co., Milwaukee, Wis.

PATTERNS—
Balkwill Pattern Works, Cleveland, O.
Buffalo Gear & Pattern Works, Buffalo, N. Y.
Forsyth Pattern Works, Youngstown, O.
Wm. Gardam & Son, New York City.
Gobeille Pattern Co., Cleveland, O.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
R. E. Kidder, Worcester, Mass.
Mahoning Foundry & Machine Co., Youngstown, O.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

PIG IRON—
See Pig Iron, Division V.

PLUMBAGO—
S. Obermayer Co., Cincinnati, O.
J. W. Paxson Co., Philadelphia, Pa.
J. D. Smith Fdy. Supply Co., Cleveland, O.

RAMMERS—
Brown & Sharpe Mfg. Co., Providence, R. I.
S. Obermayer Co., Cincinnati, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

SAWING OFF MACHINES (Steel Foundry)—
See Cutting Off Machines, Division I.

SAND (Molding)—
S. Obermayer Co., Cincinnati, O.
Ohio Sand Co., Conneaut, O.
J. D. Smith Fdy. Supply Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.

SPRUE CUTTING MACHINES—
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
F. B. Shuster & Co., New Haven, Conn.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

SEPARATORS (Metal)—
Elm City Engineering Co., New Haven, Conn.
W. W. Sly, Cleveland, O.

TRAMWAYS—
Atlas Car & Mfg. Co., Cleveland, O.
Athur Koppel, New York City.
J. W. Moyer & Co., Philadelphia, Pa.
Northern Engineering Wks., Detroit, Mich.
M. H. Treadwell & Co., New York City.

TUMBLERS—
W. W. Sly, Cleveland, O.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.

VIBRATORS (Pneumatic)—
Tabor Mfg. Co., Philadelphia, Pa.

DIVISION IV
Power Plant Equipment

AIR COMPRESSORS—
See Air Compressors, Division II.

BEARINGS (Oilless)—
North American Metaline Co., Long Island City, N. Y.

BELT DRESSING—
E. F. Houghton & Co., Philadelphia, Pa.
The Ironsides Co., Columbus, O.

BELTING—
Chicago Rawhide Mfg. Co., Chicago, Ill.
Gandy Belting Co., Baltimore, Md.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.

BLOWERS—
Buffalo Forge Co., Buffalo, N. Y.

BOILERS—
The Allis-Chalmers Co., Chicago, Ill.
The Aultman Co., Canton, O.
Wm. Cramp & Sons, Philadelphia, Pa.
Dravo, Doyle & Co., Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
Filer & Stowell Co., Milwaukee, Wis.
The Girard Boiler & Mfg. Co., Girard, O.
Hyde Bros. & Co., Pittsburg, Pa.
Harrison Safety Boiler Works, Philadelphia.
Hooven, Owens & Rentschler Co., Hamilton, O.
Meehan Boiler & Construc. Co., Lowellville, O.
G. A. Mullins, Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Wickes Bros., Saginaw, Mich.

BOILER FEEDERS—
A. S. Cameron Steam Pump Co., New York City.
Wm B. Scaife & Sons Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

BOILER TUBES—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
S. Fix Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.
Jos. T. Ryerson & Son, Chicago and New York.

BURNERS (Oil)—
See Fuel Oil Burners, Division VI.

CHAIN GRATES—
Green Engineering Co., Chicago, Ill.

COAL & ASH HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
The Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.
Athur Koppel, New York City.
Link-Belt Machinery Co., Chicago, Ill.
J. W. Moyer & Co., Philadelphia, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.

CONDENSERS—
A. S. Cameron Steam Pump Works, New York City.
Filer & Stowell Co., Milwaukee, Wis.
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Vilter Mfg. Co., Milwaukee, Wis.

COUPLINGS (Compression)—
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago, Ill.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Geo. B. Sennett Co., Youngstown, O.
Vandegrift Coupling Co., Evansville, Ind.

DYNAMOS AND MOTORS—
See Electrical Machinery, Division II.

ECONOMIZERS (Fuel)—
Green Fuel Economizer Co., Matteawan, N. Y.

ENGINES (Blowing)—
The Allis-Chalmers Co., Chicago, Ill.
Mesta Machine Co., Pittsburg, Pa.
Southwark Fdy. & Mach. Co., Philadelphia, Pa.
The Wm. Tod Co., Youngstown, O.

ENGINES (Corliss)—
Allis-Chalmers Co., Chicago, Ill.
Brown Corliss Engine Co., Corliss, Wis.
Filer & Stowell Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O.
Mesta Machine Co., Pittsburg, Pa.
G. A. Mullins, Chicago, Ill.
Vilter Mfg. Co., Milwaukee, Wis.
Wickes Bros., Saginaw, Mich.

ENGINES (Gas)—
National Gear Wheel & Fdy. Co., Allegheny, Pa.
Northern Engineering Works, Detroit, Mich.

ENGINES (Hoisting)—
Allis-Chalmers Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
J. S. Mundy, Newark, N. J.

ENGINES (Multiple Cylinder)—
Jos. E. Wise, Philadelphia, Pa.

ENGINES (Steam)—
The Allis-Chalmers Co., Chicago, Ill.
The Aultman Co., Canton, O.
Brown Corliss Engine Co., Corliss, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Dake Engine Co., Grand Haven, Mich.
Dravo Doyle & Co., Pittsburg, Pa.
The Filer-Stowell Co., Milwaukee, Wis.
Great Lakes Engineering Works, Detroit, Mich.
I. & E. Greenwald Co., Cincinnati, O.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Mesta Machine Co., Pittsburg, Pa.
G. A. Mullins, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
The Wm. Tod Co., Youngstown, O.
Vilter Mfg. Co., Milwaukee, Wis.
Wickes Bros., Saginaw, Mich.
Joseph E. Wise, Philadelphia, Pa.

ENGINES (Reversing)—
Wm. Tod Co., Youngstown, O.

FANS (Exhaust and Ventilating)—
Buffalo Forge Co., Buffalo, N. Y.

FEED WATER HEATERS & PURIFIERS—
James Bonar & Co., Pittsburg, Pa.
Dravo Doyle & Co., Pittsburg, Pa.
Green Fuel Economizer Co., Matteawan, N. Y.
I. & E. Greenwald Co., Cincinnati, O.
Harrison Safety Boiler Works, Philadelphia.
G. A. Mullins, Chicago, Ill.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
A. T. Throop & Co., Buffalo, N. Y.

FILTERS (Oil)—
James Bonar & Co., Pittsburg, Pa.
J. R. Vandyck Co., New York City.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

GRATE BARS—
Green Engineering Co., Chicago, Ill.
A. T. Throop & Co., Buffalo, N. Y.
M. H. Treadwell & Co., New York City.

GREASE CUPS—
Lunkenheimer Co., Cincinnati, O.
Winkley Co., Hartford, Conn.

HANGERS—
The Aultman Co., Canton, O.
Baker Bros., Toledo, O.
Bourne-Fuller Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago.
Dodge Mfg. Co., Mishawaka, Ind.
I. & E. Greenwald Co., Cincinnati, O.
John Hutchinson Mfg. Co., Jackson, Mich.
W. A. Jones Foundry & Mach. Co., Chicago.
Link-Belt Machinery Co., Chicago, Ill.

INJECTORS—
Crane Co., Chicago, Ill.
Eynons-Evans Mfg. Co., Philadelphia, Pa.
Jenkins Bros., New York City.
The Lunkenheimer Co., Cincinnati, O.

LUBRICANTS—
E. F. Houghton & Co., Philadelphia, Pa.
The Ironsides Co., Columbus, O.
North American Metaline Co., Long Island City, N. Y.
Jos. Dixon Crucible Co., Jersey City, N. J.

LUBRICATORS—
Jas. Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

MECHANICAL DRAFT APPARATUS—
Buffalo Forge Co., Buffalo, N. Y.

METAL (ANTI-FRICTION)—
See Anti-Friction Metal, Division VI.

METALINED BEARINGS—
North American Metaline Co., Long Island City, N. Y.

OILS (MACHINERY)—
E. F. Houghton & Co., Philadelphia, Pa.

PACKING—
Jas. Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE FITTERS—
Central Pipe & Valve Co., Allegheny, Pa.

POWER TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
Bertsch & Co., Cambridge City, Ind.
H. W. Caldwell & Son Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
The Filer & Stowell Co., Milwaukee, Wis.
I. & E. Greenwald Co., Cincinnati, O.
John Hutchison Mfg. Co., Jackson, Mich.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry & Machine Co., Chicago.
Link-Belt Machinery Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PULLEYS—
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago.
Dodge Mfg. Co., Mishawaka, Wis.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry & Machine Co., Chicago.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Link-Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PULLEYS (STEEL FACED)—
Federal Mfg. Co., Cleveland, O.

PUMPS (HYDRAULIC)—
Waterbury Farrel Fdy. & Mach. Co., Waterbury, Conn.

PUMPS (STEAM)—
The Allis-Chalmers Co., Chicago, Ill.
A. S. Cameron Steam Pump Works, New York City.
Dravo Doyle & Co., Pittsburg, Pa.
The Filer & Stowell Co., Milwaukee, Wis.
Great Lakes Engineering Works, Detroit, Mich.
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

SEPARATORS AND EXTRACTORS (STEAM OR OIL)—
Austin Separator Co., Detroit, Mich.
James Bonar & Co., Pittsburg, Pa.
J. Wendell Cole, Columbus, O.
Green Fuel Economizer Co., Matteawan, N. Y.
Harrison Safety Boiler Works, Philadelphia.
Wm B. Scaife & Sons Co., Pittsburg, Pa.
A. T. Throop & Co., Buffalo, N. Y.
J. R. Vandyck Co., New York City.
Wright Mfg. Co., Detroit, Mich.

SHAFTING—
American Steel & Wire Co., Chicago, Ill.
The Aultman Co., Canton, O.
Baker Bros., Toledo, O.
Bassett-Presley Co., Cleveland, O.
The Bourne-Fuller Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago.
Columbus Forge & Iron Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
Joseph Dyson & Sons, Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Foundry & Mach. Co., Chicago.
Link-Belt Machinery Co., Chicago, Ill.
Jos. T. Ryerson & Son, Chicago & New York.
Stilwell-Bierce & Smith-Vaile, Co., Dayton, O.

STEAM SPECIALTIES—
Austin Separator Co., Detroit, Mich.
Jas. Bonar & Co., Pittsburg, Pa.
Bowen Mfg. Co., Auburn, N. Y.
A. S. Cameron Steam Pump Works, New York City.
Crane Co., Chicago, Ill.
Eynon-Evans Mfg. Co., Philadelphia, Pa.
Harrison Safety Boiler Works, Philadelphia.
Lunkenheimer Co., Cincinnati, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
J. R. Vandyck Co., New York City.
Winkley Co., Hartford, Conn.
Wright Mfg. Co., Detroit, Mich.

STEAM & HYDRAULIC EQUIPMENT.
Central Pipe & Valve Co., Allegheny, Pa.

STOKERS—
Green Engineering Co., Chicago, Ill.

TRAPS (STEAM)—
James Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
E. F. Houghton & Co., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
J. R. Vandyck, New York City.
Wright Mfg. Co., Detroit, Mich.

TRANSMISSION ROPE (MANILA)—
American Mfg. Co., New York City.
Dodge Mfg. Co., Mishawaka, Ind.
Link-Belt Machinery Co., Chicago, Ill.

TRAVELING LINK GRATES—
Green Engineering Co., Chicago, Ill.

VALVES—
Central Pipe & Valve Co., Allegheny, Pa.
Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Jenkins Bros., New York City.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Vincent Valve Co., Sandusky, O.
R. D. Wood & Co., Philadelphia, Pa.

WATER COLUMNS AND ALARMS—
James Bonar & Co., Pittsburg, Pa.
The Lunkenheimer Co., Cincinnati, O.
J. R. Vandyck Co., New York City.
Wright Mfg. Co., Detroit, Mich.
Crane Co., Chicago, Ill.

WATER SOFTENING PLANTS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

DIVISION V
Iron and Steel

AGRICULTURAL SHAPES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Jos. T. Ryerson & Son, Chicago and New York.

AIR BRAKE PINS—
Vulcanus Forging Co., Cleveland, O.

ANGLES—
See Structural Steel, Division V.

BARS (IRON AND STEEL)—
American Galvanizing Works, Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Denman & Davis, New York City.
John Eichleay, Jr., Co., Pittsburg, Pa.
Forest City Steel & Iron Co., Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Ohio Steel & Iron Specialty Co., Cuyahoga Falls, O.
Republic Iron & Steel Co., Chicago, Ill.
Jos. T. Ryerson & Son, Chicago and New York.
W. H. Thomson & Co., Philadelphia, Pa.

BEAMS—
See Structural Steel, Division V.

BOLTS AND NUTS—
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bassett-Presley Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Milton Manufacturing Co., Milton, Pa.
National Elastic Nut Co., Milwaukee, Wis.
Upson Nut Co., Cleveland, O.
Vulcanus Forging Co., Cleveland, O.

CASTINGS (ALUMINUM, BRASS AND BRONZE)—
Frank W. Bacon, Erie, Pa.
Lorain Foundry Co., Lorain, O.
Lunkenheimer Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.
Vincent Valve Co., Sandusky, O.

CASTINGS (GRAY IRON)—
The Aultman Co., Canton, O.
Bessemer Fdy. Co., Grove City, Pa.
Birmingham Iron Foundry, Derby, Conn.
Buffalo Foundry Co., Buffalo, N. Y.
A. M. Crane & Co., Chicago, Ill.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Great Lakes Engineering Wks., Detroit, Mich.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Lehr Agricultural Co., Fremont, O.
Lorain Foundry Co., Lorain, O.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Richmond City Mill Wks., Richmond, Ind.
Geo. B. Sennett Co., Youngstown, O.
Wm. Tod & Co., Youngstown, O.
M. H. Treadwell & Co., New York City.

CASTINGS (MACHINERY)—
The Aultman Co., Canton, O.
Bessemer Foundry Co., Grove City, Pa.
Birmingham Iron Foundry, Derby, Conn.
Buffalo Foundry Co., Buffalo, N. Y.
A. M. Crane & Co., Chicago, Ill.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Great Lakes Engineering Wks., Detroit, Mich.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Mesta Machine Co., Pittsburg, Pa.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Russel Wheel & Fdy. Co., Detroit, Mich.
Geo. B. Sennett Co., Youngstown, O.
M. H. Treadwell & Co., New York City.
United Engineering & Fdy. Co., Pittsburg, Pa.

CASTINGS (MALLEABLE)—
Acme Steel & Malleable Iron Works, Buffalo.
American Malleable Iron Co., Chicago.
Buhl Malleable Co., Detroit, Mich.
Meadville Malleable Iron Co., Meadville, Pa.

CASTINGS (SEMI-STEEL)—
Birmingham Iron Foundry, Derby, Conn.
Farrel Fdy. & Mach. Co., Ansonia, Conn.

CASTINGS (STEEL)—
Acme Steel & Malleable Iron Works, Buffalo.
A. M. Crane & Co., Chicago, Ill.
Denman & Davis, New York City.
Mesta Machine Co., Pittsburg, Pa.
Newark Iron & Steel Co., Newark, O.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Otis Steel Co., Cleveland, O.
Tool Steel Casting Co., Boston, Mass.
Uniform Steel Co., Rahway, N. J.

CHAINS—
Bassett-Presley Co., Cleveland, O.
Federal Mfg. Co., Cleveland, O.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Todd-Obenchain Co., New Albany, Ind.

CHAINS (MACHINERY)—
Federal Mfg. Co., Cleveland, O.

CHANNELS—
See Structural Steel, Division V.

CHROME ORE—
Geo. G. Blackwell, Sons & Co., Ltd., Liverpool, England.

CORRUGATED IRON—
American Sheet Steel Co., New York City.
Bassett-Presley Co., Cleveland, O.
Berger Mfg. Co., Canton, O.
J. M. & L. A. Osborn Co., Cleveland, O.
Jos. T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
W. H. Thomson & Co., Philadelphia, Pa.

FORGINGS (DIE)—
Crucible Steel Forge Co., Cleveland, O.
Joseph Dyson & Son, Cleveland, O.
Machinery Forging Co., Cleveland, O.
Wm B. Scaife & Sons Co., Pittsburg, Pa.
Transue & Williams Co., Alliance, O.
J. H. Williams & Co., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

FORGINGS (DROP)—
Billings & Spencer Co., Hartford, Conn.
E. D. Clapp Mfg. Co., Auburn, N. Y.
Crucible Steel Forge Co., Cleveland, O.
Joseph Dyson & Sons, Cleveland, O.
Great Lakes Engineering Works, Detroit, Mich.
The Machinery Forging Co., Cleveland, O.
Pilling & Crane, Philadelphia, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Wm B. Scaife & Sons Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Tindel-Morris Co., Eddystone, Pa.

Transue & Williams Co., Alliance, O.
Union Drop Forge Co., Chicago, Ill.
Vulcanus Forging Co., Cleveland, O.
J. H. Williams & Co., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

FORGINGS (HYDRAULIC PRESS)—
Wyman & Gordon, Worcester, Mass.

FORGINGS (ROLL)—
Ohio Steel & Iron Specialty Co., Cuyahoga Falls, O.
Pittsburg Shear Knife & Mach. Co., Pittsburg, Pa.
Tindel-Morris Co., Eddystone, Pa.

GALVANIZED IRON AND STEEL—
American Galvanizing Works, Chicago, Ill.
American Sheet Steel Co., New York City.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Cleveland Galvanizing Works, Cleveland, O.
J. M. & L. A. Osborn Co., Cleveland, O.
Jos. T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
W. H. Thomson & Co., Philadelphia, Pa.

HOOPS (STEEL)—
See Steel Hoops, Division V.

INGOT MOLDS—
Reed F. Blair & Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Wm. Tod Co., Youngstown, O.

IRON ORES—
Geo. G. Blackwell Sons & Co., Liverpool, England.
Reed F. Blair & Co., Pittsburg, Pa.
Corrigan, McKinney & Co., Cleveland, O.
The Dessau Co., New York City.
Drake, Bartow & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Ernest Law & Co., Philadelphia, Pa.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
The Tod-Stambaugh Co., Cleveland, O.

METALS (ANTIMONY, COPPER, TIN, ETC.)—
Bassett-Presley Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
J. M. & L. A. Osborn Co., Cleveland, O.
Jos. T. Ryerson & Son, Chicago & New York.
N. & G. Taylor Co., Philadelphia, Pa.

NUTS AND BOLTS—
See Bolts and Nuts, Division V.

NUTS (SELF-LOCKING)—
National Elastic Nut Co., Milwaukee, Wis.

PIG IRON—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
C. R. Baird & Co., Philadelphia, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
Cabeen & Co., Philadelphia, Pa.
Clinton Iron & Steel Co., Pittsburg, Pa.
Columbus Iron & Steel Co., Columbus, O.
Corrigan, McKinney & Co., Cleveland, O.
J. K. Dimmick & Co., Philadelphia, Pa.
Esterly & Clancy, Cleveland, O.
Field-Croxton Iron Co., Cincinnati, O.
M. A. Hanna & Co., Cleveland, O.
F. B. Hawkins Co., New York City.
Hickman, Williams & Co., Chicago, Ill.
Geo. T. Johnson & Co., Philadelphia, Pa.
Ernest Law & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pickands Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Pilling & Crane, Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Shenango Furnace Co., Pittsburg, Pa.
F. B. Stevens, Detroit, Mich.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Thomas Furnace Co., Milwaukee, Wis.
L. & R. Wister & Co., Philadelphia, Pa.

PLATES—
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Denman & Davis, New York City.
John Eichleay, Jr., Co., Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
Girard Boiler & Mfg. Co., Girard, O.
Globe Rolling Mill Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
Republic Iron & Steel Co., Chicago, Ill.
Russel Wheel & Fdy. Co., Detroit, Mich.
Joseph T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
N. & G. Taylor Co., Philadelphia, Pa.
Wyoming Shovel Works, Wyoming, Pa.

RAILS—
American Steel Hoop Co., Pittsburg, Pa.
The Atlas Car & Mfg. Co., Cleveland, O.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Arthur Koppel, New York City.
Ernest Law & Co., Philadelphia, Pa.
Lorain Steel Co., Lorain, O.
Ohio Steel & Iron Specialty Co., Cuyahoga Falls, O.
N. & G. Taylor Co., Philadelphia, Pa.

RIVETS—
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Forest City Steel & Iron Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
Jos. T. Ryerson & Son, Chicago and New York.
Vulcanus Forging Co., Cleveland, O.

SCRAP IRON—
Jacob Cohen, Jacksonville, Ill.
Cohen, Nagusky & Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

SHEET METAL STAMPINGS—
Federal Mfg. Co., Cleveland, O.
Lyon Metallic Mfg. Co., Chicago, Ill.

SHEETS (IRON AND STEEL)—
American Sheet Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Denman & Davis, New York City.
Globe Rolling Mill Co., Cincinnati, O.
Goff, Horner & Co., Pittsburg, Pa.
Arthur C. Harvey Co., Boston, Mass.
Niles Iron & Sheet Co., Niles, O.
J. M. & L. A. Osborn Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Steel & Iron Aluminum Coating Co., Connellsville, Pa.
N. & G. Taylor Co., Philadelphia, Pa.
W. H. Thomson & Co., Philadelphia, Pa.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.
Wyoming Shovel Works, Wyoming, Pa.
Zug & Co., Pittsburg, Pa.

SILICON SPIEGEL—
Reed F. Blair & Co., Pittsburg, Pa.

SPIKES—
A. M. Crane & Co., Chicago, Ill.

STEEL—
American Galvanizing Works, Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
C. R. Baird & Co., Philadelphia, Pa.
The Bassett Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
Cohen, Nagusky & Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Cuyahoga Wire & Fence Co., Cuyahoga Falls, Ohio.
Denman & Davis, New York City.
J. K. Dimmick & Co., Philadelphia, Pa.
John Eichleay, Jr., Co., Pittsburg, Pa.
Forest City Steel & Iron Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
Wm. Jessop & Son, New York City.
Geo. T. Johnson & Co., Philadelphia, Pa.
Ernest Law & Co., Philadelphia, Pa.
Newark Iron & Steel Co., Newark, O.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Jos. T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
N. & G. Taylor Co., Philadelphia, Pa.
W. H. Thomson & Co., Philadelphia, Pa.
L. & R. Wister & Co., Philadelphia, Pa.

STEEL BANDS—
American Galvanizing Works, Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.

STEEL BLOOMS AND BILLETS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
A. M. Crane & Co., Chicago, Ill.
Geo. T. Johnson & Co., Philadelphia, Pa.
Ernest Law & Co., Philadelphia, Pa.
The Lorain Steel Co., Lorain, O.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
Jos. T. Ryerson & Son, Chicago and New York.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.

STRUCTURAL STEEL—
American Galvanizing Works, Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
Reed F. Blair & Co., Pittsburg, Pa.
G. L. Bollinger Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
A. M. Crane & Co., Chicago.
John Eichleay, Jr., Co., Pittsburg, Pa.
Forest City Steel & Iron Co., Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
F. B. Hawkins Co., New York City.
McClintic-Marshall Const. Co., Pittsburg, Pa.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Russel Wheel & Fdy. Co., Detroit, Mich.
Jos. T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

TANKS—
The Aultman Co., Canton, O.
W. E. Caldwell Co., Louisville, Ky.
A. M. Crane & Co., Chicago, Ill.
Enterprise Boiler Co., Youngstown, O.
Girard Boiler & Manufacturing Co., Girard, O.
I. & E. Greenwald Co., Cincinnati, O.
Meehan Boiler & Cons. Co., Lowellville, O.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jos. T. Ryerson & Son, Chicago and New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
M. H. Treadwell & Co., New York City.

TIN AND TERNE PLATES—
American Tin Plate Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
J. M. & L. A. Osborn Co., Cleveland, O.
N. & G. Taylor Co., Philadelphia, Pa.
Jos. T. Ryerson & Son, Chicago and New York.

TOOL STEEL—
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Colonial Steel Co., Pittsburg, Pa.
Denman & Davis, New York City.
J. K. Dimmick & Co., Philadelphia, Pa.
Arthur C. Harvey Co., Boston, Mass.
Wm. Jessop & Son, New York City.
Edwin R. Kent & Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
Jos. T. Ryerson & Son, Chicago and New York.

TUBES—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
S. Fix's Sons, Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
National Tube Co., Pittsburg, Pa.
Jos. T. Ryerson & Son, Chicago and New York.

TURNBUCKLES—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Republican Iron & Steel Co., Chicago, Ill.
Jos. T. Ryerson & Son, Chicago and New York.

WASHERS—
American Iron & Steel Mfg. Co., Lebanon, Pa.
Avery Stamping Co., Cleveland, O.
Bassett-Presley Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.
Jos. T. Ryerson & Son, Chicago and New York.
N. & G. Taylor Co., Philadelphia, Pa.
Upson Nut Co., Cleveland, O.

WIRE—
American Steel & Wire Co., Chicago, Ill.
Cuyahoga Wire & Fence Co., Cuyahoga Falls, Ohio.
J. M. & L. A. Osborn Co., Cleveland, O.
Jos. T. Ryerson & Son, Chicago and New York.

WIRE (BARBED AND FENCE)—
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Cuyahoga Wire & Fence Co., Cuyahoga Falls, Ohio.

WIRE (CABLE AND ROPE)—
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.

WIRE (NAILS)—
American Steel & Wire Co., Chicago, Ill.
Cuyahoga Wire & Fence Co., Cuyahoga Falls, Ohio.
J. M. & L. A. Osborn Co., Cleveland, O.

WROUGHT PIPE—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Crane Co., Chicago.
National Tube Co., Pittsburg, Pa.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.

DIVISION VI

Miscellaneous Equipment and Supplies

ANNEALING BOXES—
Girard Boiler & Mfg. Co., Girard, O.
Meehan Boiler & Cons. Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm B. Scaife & Sons Co., Pittsburg, Pa.

ANTI FRICTION METAL—
Cool Running Graphite Metal Co., Cincinnati, Ohio.
Wm. Cramp & Sons S. & E. Bldg. Co., Philadelphia, Pa.
North American Metaline Co., Long Island City, N. Y.
J. J. Ryan & Co., Chicago, Ill.

AUTOMOBILE PARTS—
Federal Mfg. Co., Cleveland, O.

BALLS (STEEL)—
Federal Mfg. Co., Cleveland.

BABBITT METAL—
Bassett-Presley Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.
J. J. Ryan & Co., Chicago, Ill.
N. & G. Taylor Co., Philadelphia, Pa.

BARROWS (WHEEL)—
See Barrows, Division III.

BELT DRESSING—
See Belt Dressing, Division IV.

BELTING—
See Belting, Division IV.

BLAST FURNACE WORK—
Enterprise Boiler Co., Youngstown, O.
The Girard Boiler & Mfg. Co., Girard, O.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Meehan Boiler & Construc. Co., Lowellville, O.
Henry S. Mould Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Geo. B. Sennett Co., Youngstown, O.
Southwark Fdy. & Mach. Co., Philadelphia, Pa.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
West Penn Fdy. & Mach. Co., Avonmore, Pa.

BLUE PRINTING APPARATUS—
Elliott Electric Blue Print Co., Pittsburg, Pa.

BRIDGES—
G. L. Bollinger Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

BUILDINGS (STEEL AND IRON)—
G. L. Bollinger Co., Pittsburg, Pa.
Forest City Steel & Iron Co., Cleveland, O.
McClintic-Marshall Const. Co., Pittsburg, Pa.
Pittsburg Construction Co., Pittsburg, Pa.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

CALCULATING MACHINES—
The Calculagraph Co., New York City

CARBORUNDUM—
The Carborundum Co., Niagara Falls, N. Y.

CARS (BALLAST)—
M. H. Treadwell & Co., New York City.

CARS (CINDER AND HOT METAL)—
Atlas Car & Mfg. Co., Cleveland, O.
Arthur Koppel, New York City.
Wm. B. Pollock Co., Youngstown, O.
M. H. Treadwell & Co., New York City.

CARS (INDUSTRIAL AND MINE)—
Atlas Car & Mfg. Co., Cleveland, O.
A. M. Crane & Co., Chicago, Ill.
Arthur Koppel, New York City.
Edgar S. Low Co., Pittsburg, Pa.
Northern Engineering Wks., Detroit, Mich.
Wm. B. Pollock Co., Youngstown, O.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.

CEILINGS—
Berger Mfg. Co., Canton, O.

CEMENT—
Reed F. Blair & Co., Pittsburg, Pa.

CHAIN BELTING—
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
The Metallurgical Laboratory, Pittsburg, Pa.
O. Texter, Cleveland, O.

COAL AND COKE—
Alabama Consolidated Coal & Iron Co., Birmingham, Ala.
Bessemer Coke Co., Pittsburg, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Crerar Clinch & Co., Chicago, Ill.
J. K. Dimmick & Co., Philadelphia, Pa.
H. C. Frick Coke Co., Pittsburg, Pa.
M. A. Hanna & Co., Cleveland, O.
Geo. T. Johnson & Co., Philadelphia, Pa.
Ernest Law & Co., Philadelphia, Pa.
Leckrone Coke Co., Uniontown, Pa.
McKeefrey & Co., Leetonia, O.
Pilling & Crane, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
W. H. Thomson & Co., Philadelphia, Pa.
L. & R. Wister & Co., Philadelphia, Pa.

COKE OVENS—
Retort Coke Oven Co., Cleveland, O.
United Coke & Gas Co., New York City.

COMMUTATORS—
Van Dorn-Elliott Electric Co., Cleveland, O.

COMPAROMETERS—
The Pullman Co., Pittsburg, Pa.

DERRICKS—
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.

DRILLING COMPOUND—
Peerless Drilling Compound Co., Utica, N. Y.

DRAWING ROOM SUPPLIES—
Elliott Electric Blue Print Co., Pittsburg, Pa.

DRIP PANS—
Lyon Metallic Mfg. Co., Chicago, Ill.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.
J. M. & L. A. Osborn, Cleveland, O.

ELEVATORS—
Morse Williams & Co., Philadelphia, Pa.

EMERY WHEELS—
J. Wendell Cole, Columbus, O.
Norton Emery Wheel Co., Worcester, Mass.
Chas. G. Smith Co., Pittsburg, Pa.
The Tanite Co., Stroudsburg, Pa.

ENGINEERS AND CONTRACTORS—
Associated Engineering Co., Pittsburg, Pa.
Victor Buetner, Pittsburg, Pa.
G. L. Bollinger Co., Pittsburg, Pa.
Central Pipe & Valve Co., Allegheny, Pa.
J. W. Cruikshank, Pittsburg, Pa.
Duff Patents Co., Pittsburg, Pa.
E. E. Erickson, Pittsburg, Pa.
Eynon-Evans Mfg. Co., Philadelphia, Pa.
Garrett-Cromwell Engineering Co., Cleveland.
J. A. Herrick, Philadelphia, Pa.
S. V. Huber & Co., Pittsburg, Pa.
Robt. W. Hunt & Co., Chicago, Ill.
Iron City Engineering Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Julian Kennedy, Pittsburg, Pa.
Walter Kennedy, Pittsburg, Pa.
David Lamond & Son, Pittsburg, Pa.
Alex. Laughlin & Co., Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
McClintic-Marshall Const. Co., Pittsburg, Pa.
George W. McClure, Son & Co., Pittsburg, Pa.
E. L. McGary, Pittsburg, Pa.
Meehan Boiler & Cons. Co., Lowellville, O.
The Metallurgical Laboratory, Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
Pittsburg Construction Co., Pittsburg, Pa.
Pittsburg Steel Construction Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
Powell & Colne, New York City.
Retort Coke Oven Co., Cleveland, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Emil Swensson, Pittsburg, Pa.
Hugh L. Thompson, Waterbury, Conn.
A. T. Throop & Co., Buffalo, N. Y.
M. H. Treadwell & Co., New York City.
F. H. Treat Pittsburg, Pa.
United Coke & Gas Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

FERRO-MANGANESE—
Reed F. Blair & Co., Pittsburg, Pa.

FIRE BRICK AND CLAY—
See Fire Brick, Division III.

FORGES (PORTABLE)—
Buffalo Forge Co., Buffalo, N. Y.
The Pullman Co., Pittsburg, Pa.
Rockwell Engineering Co., New York City.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.
Tate, Jones & Co., Pittsburg, Pa.
Union Drop Forge Co., Chicago, Ill.

FURNACES—
J. A. Herrick, Philadelphia, Pa.
Morgan Construction Co., Worcester, Mass.

GALVANIZING POTS—
Enterprise Boiler Co., Youngstown, O.
Girard Boiler & Mfg. Co., Girard, O.
Meehan Boiler & Cons. Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.

GAS PRODUCERS—
The Duff Patents Co. Pittsburg, Pa.
Eynon-Evans Mfg. Co., Philadelphia, Pa.
J. A. Herrick, Philadelphia, Pa.
Morgan Construction Co., Worcester, Mass.
R. D. Wood & Co., Philadelphia, Pa.

GRAPHITE PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.

HARDWARE SPECIALTIES—
Federal Mfg. Co., Cleveland, O.

HORSE SHOES—
American Steel & Wire Co., Chicago, Ill.
Phoenix Horse Shoe Co., Joliet, Ill.

INSURANCE (BOILER)—
Hartford Steam Boiler Ins. & Ins. Co., Hartford, Conn.

LAG SCREWS—
Bassett-Presley Co., Cleveland, O.
Vulcanus Forging Co., Cleveland, O.

LATHE PANS—
Lyon Metallic Mfg. Co., Chicago, Ill.

LIMESTONE—
Reed F. Blair & Co., Pittsburg, Pa.

LINK BELTING—
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Fdry. & Mach. Co., Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.

LOCKERS (CLOTHES)—
Merritt & Co., Philadelphia, Pa.

LOCOMOTIVES (INDUSTRIAL AND MINE)—
A. M. Crane & Co., Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Edgar S. Low Co., Pittsburg, Pa.

LUBRICANTS—
See Lubricants, Division IV.

MANUFACTURING CHEMISTS—
Grasselli Chemical Co., Cleveland, O.

METAL BEARINGS—
See Anti-Friction Metal, Division VI.

METAL CEILINGS—
Berger Mfg. Co., Canton, O.

MOTORS—
See Electrical Machinery, Division II.

OIL BURNERS—
See Fuel Oil Burners, Division VI.

OIL (CUTTING)—
E. F. Houghton & Co., Philadelphia, Pa.
Peerless Drilling Compound Co., Utica, N. Y.

OIL TANKS AND CARS—
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
M. H. Treadwell & Co., New York City.

ORE BARROWS—
Akron Cultivator Co., Akron, O.
Atlas Car & Mfg. Co., Cleveland, O.

ORE SCREENS—
See Perforated Metal, Division VI.

PAINT—
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PERFORATED METALS—
Robt. Aitchison Per. Metal Co., Chicago, Ill.
The Allis-Chalmers Co., Chicago, Ill.
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIPE (CAST IRON)—
R. D. Wood & Co., Philadelphia, Pa.

PIPE (RIVETED STEEL)—
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

PIPE (WROUGHT)—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Crane Co., Chicago.
National Tube Co., Pittsburg, Pa.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.

PIPE COVERING—
Central Pipe & Valve Co., Allegheny, Pa.
Jenkins Bros., New York City.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
The Fullman Co., Pittsburg, Pa.

ROOFS—
Berger Mfg. Co., Canton, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

ROPE AND CORDAGE—
American Mfg. Co., N. Y. City.
Dodge Mfg. Co., Mishawaka, Ind.
Link-Belt Machinery Co., Chicago, Ill.

SCREWS—
Bassett-Presley Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill.
Illinois Screw Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

SHOVELS—
Wyoming Shovel Works, Wyoming, Pa.

STACKS—
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

STAND PIPES—
Enterprise Boiler Co., Youngstown, O.
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm B. Scaife & Sons Co., Pittsburg, Pa.

STEAM SHOVELS AND DREDGES—
Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Thew Automatic Shovel Co., Lorain, O.

STEEL PLANTS (BUILDERS OF)—
J. A. Herrick, Philadelphia, Pa.
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Wellman-Seaver-Morgan Eng. Co., Cleveland.

STEEL STRIPS—
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.

SURVEYING INSTRUMENTS—
Elliott Electric Blue Print Co., Pittsburg, Pa.

TANKS—
See Tanks, Division V.

TEMPERING COMPOUND—
C. A. Mosso, Dryden, N. Y.

TIME CLOCKS—
E. Imhauser & Co., New York City.

TOTE BOXES—
Lyon Metallic Mfg. Co., Chicago, Ill.

TROPENAS PROCESS—
Powell & Colne, New York City.

TUBE WELDING—
S. Fix's Sons, Cleveland, O.

VENTILATORS—
Buffalo Forge Co., Buffalo, N. Y.
J. M. & L. A. Osborn Co., Cleveland, O.

WATER TANKS—
W. E. Caldwell Co., Louisville, Ky.
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.

WHEELBARROWS—
See Barrows (Wheel), Division III.

WIRE ROPE COATING—
Ironsides Co., Columbus, O.

WIRE ROPE FILLER—
Ironsides Co., Columbus, O.

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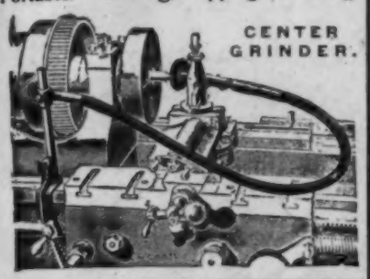

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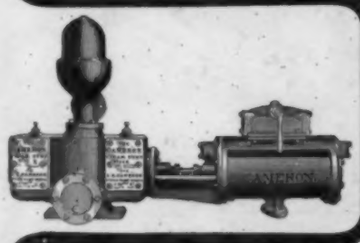

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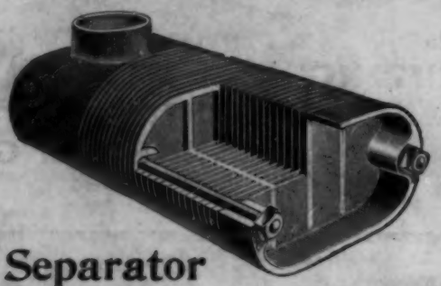

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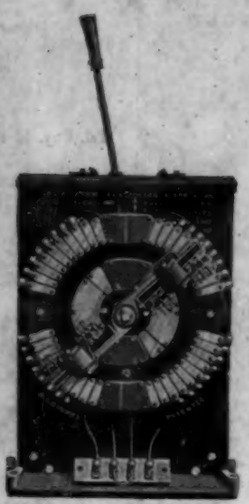

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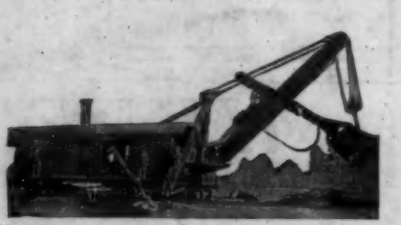

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